Chapter 2. Alternatives, Including the Proposed Action

Introduction

The Council on Environmental Quality (CEQ) was established by NEPA in the Executive Office of the President. Among its other duties, CEQ drafted and promulgated the regulations for implementing NEPA, located at Parts 1500–1508 in Title 40, Chapter V of the Code of Federation Regulations (CFR). Section 1502.14 of the NEPA Regulations addresses "alternatives including the proposed action," which the CEQ states is "the heart of the environmental impact statement."

Section 1502.14 directs Federal agencies to:

a. Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated.

b. Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits.

c. Include reasonable alternatives not within the jurisdiction of the lead agency.

d. Include the alternative of no action.

e. Identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference.

f. Include appropriate mitigation measures not already included in the proposed action or alternatives.

This chapter describes and compares the alternatives considered for the proposed Roca Honda Mine. It includes a description and map of each alternative considered. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative and some of the information is based upon the environmental, social, and economic effects of implementing each alternative.

Alternatives Considered in Detail

The Forest Service developed three alternatives, including the no action and proposed action alternatives, in response to issues raised by the public.

Alternative 1 – No Action

As just noted, Section 1502.14 of the NEPA Regulations directs the Cibola National Forest to consider the no action alternative with regard to RHR's proposed plan of operations for the Roca Honda Mine. Under the no action alternative, the Roca Honda Mine would neither be constructed nor operated. However, for purposes of NEPA analysis and disclosure, the no action alternative provides a baseline for comparison of the effects of the action alternatives.

The General Mining Act of 1872 confers a statutory right to enter upon public lands open to location in pursuit of locatable minerals, and to conduct mining activities, in compliance with Federal and state statutes and regulations. The Multiple-Use Mining Act of 1955 confirms the ability to conduct mining activities on public lands, locate necessary facilities, and conduct reasonable and incidental uses to mining on public lands, including National Forest System lands. Forest Service locatable mineral mining regulations at 36 C.F.R. Part 228 subpart A, correspondingly recognize the rights of mining claimants. Under 36 C.F.R. Part 228, Subpart A and 30 U.S.C. § 612(a), the Forest Service ensures proposed activities are required for, and reasonably incidental to, prospecting, mining, or processing operations, and ensure operations minimize adverse environmental effects. The Forest Service may reject an unreasonable or illegal plan of operations, but cannot categorically prohibit mining activity or deny reasonable and legal mineral operations under the mining laws. Havasupai Tribe v. U.S. 752 F. Supp. 1471 (9th Cir. 1990).

Before the proposed Roca Honda Mine can ever be developed, there are requirements to receive several crucial permits from New Mexico State agencies, including a New Mine Permit from MMD, a mine dewatering permit from the OSE, and a discharge permit from NMED. Furthermore, the Federal EPA may have to issue a National Pollutant Discharge Elimination System (NPDES) permit for discharges to waters of the United States.

In the next chapter, the EIS will consider the affected environment and the environmental consequences of the no action alternative.

Alternative 2 –The Proposed Action: Accept Mine Operations Plan and Approve Project-Specific Forest Plan Amendment

The proposed action is to approve the mine operations plan (revision 1) submitted by RHR and approve the project-specific forest plan amendment described in chapter 1 and below. This proposed action was not developed by the Cibola National Forest in response to an identified purpose and need, but instead was brought to the Forest Service by RHR in accordance with its rights under the General Mining Law of 1872 and Forest Service mining regulations at 36 CFR 228 Subpart A. In addition, the proposed action is also subject to State of New Mexico permitting and regulatory requirements.

Roca Honda Mine Plan of Operations

Forest Service mining regulations at 36 CFR 228.4(a)(3) require a potential mine operator to submit a plan of operations “if the proposed operations will likely cause a significant disturbance of surface resources.” In 2009, RHR initially submitted a permit application consisting of five documents:

1. Roca Honda Resources, LLC, “Permit Application for the Roca Honda Mine” (October 2009)
2. Roca Honda Resources, LLC, “Sampling and Analysis Plan for the Roca Honda Mine” (October 2009)
3. Roca Honda Resources, LLC, “Baseline Data Report for the Roca Honda Mine” (October 2009)

4. Roca Honda Resources, LLC, “Mine Operations Plan for Roca Honda Mine” (RHR, 2009a), and
5. Roca Honda Resources, LLC, “Reclamation Plan for Roca Honda Mine” (RHR, 2009b).

This set of documents also included a Plan of Operations for Mining Operations on National Forest System Lands (Forest Service Form FS-2800-5) (RHR, 2009c).

In January 2012, RHR submitted revision 1 of the mine operations plan (plan) for Roca Honda Mine to the New Mexico Mining and Minerals Division (MMD) and the Cibola National Forest.

Forest Service mining regulations define “operations” broadly to include: “all functions, work, and activities in connection with prospecting, exploration, development, mining, or processing of mineral resources and all uses reasonably incident thereto, including roads and other means of access on lands subject to the regulations in this part, regardless of whether said operations take place on or off mining claims” (36 CFR 228.3(a)). Therefore, approval of the plan of operations would also constitute approval of road improvements, power lines, and other facilities on National Forest System lands that are reasonably “incident” or related to the proposed operations.

Proposed surface disturbance associated with the underground mine is located within portions of Sections 9, 10 and 16, Township 13 North, Range 8 West, New Mexico Principle Meridian. These sections are located in McKinley County, New Mexico, approximately 3 miles northwest of San Mateo and 22 miles northeast of Grants, New Mexico (see figures 12, 13, and 14). Sections 9 and 10 are National Forest System lands which are open to mineral entry under the General Mining Law of 1872. Section 16 is State of New Mexico land which is not subject to the regulatory jurisdiction of the Forest Service, but rather under the jurisdiction of the New Mexico State Land Office. Each section is a 1-mile-square area, that is an approximate square with four sides each measuring 5,280 feet in length, perpendicular and parallel to each other, and encompassing approximately 640 acres. RHR proposes a mine permit area of 1,968 acres, including 48 acres of haul roads, utility corridor and mine dewater discharge pipeline corridor outside of Sections 9, 10, and 16. There are 183 acres of disturbance within Sections 9, 10, and 16, plus 35 acres outside those sections for a total disturbance area of 218 acres.

Additional surface disturbance associated with mine haul roads is proposed for several sections outside the permit area. In Section 11, an existing forest road would be upgraded to accommodate haul truck traffic and furnish general access to the Section 10 facilities. It would also be rerouted to the extent necessary (approximately 8 acres) to avoid archaeological resources. Likewise, the existing road on private land in Sections 17 and 20 providing access to Section 16 would be rerouted and/or upgraded as necessary (approximately 7,656 feet in length or 10 acres in Sections 17 and 20) to serve as a haul road. A portion of the utility corridor is located on private land in Section 15 and totals approximately 5,016 feet or 4 acres of disturbance.

Most of the surface facilities for the proposed Roca Honda Mine would be located in Section 16 on New Mexico State Lease HG-0036. Remaining facilities and surface features would be situated on Cibola National Forest lands in Sections 9 and 10. Figure 15 shows the general surface facility footprints and associated disturbed area of the proposed mine project. Figures 16, 17, and 18 show surface facilities on Sections 16, 9, and 10. These figures have been updated from earlier versions to depict the most recent detailed design of the plan.

Figure 12. Regional map depicting proposed Roca Honda Mine within northern New Mexico

Figure 13. View of project area from Section 10

Figure 14. Power line crossing Section 16 portion of project site

Figure 15 also shows the location of a treated mine water (water reuse) transportation line and corridor leaving the mine permit area at the southeast corner of Section 10. This 20-inch diameter pipeline would run along the haul road to the southeast corner of Section 11 then turn north for a distance of approximately 6 miles where the water would be discharged onto private land. This water line is a substantial new addition to the plan, not previously proposed in RHR's October 2009 permit application.

In brief, the water reuse pipeline was proposed by RHR in response to Agency concerns and comments received upon review of RHR's October 2009 submittal and during public and Agency scoping. Concerns were expressed regarding potential adverse impacts of discharge of water upon the San Mateo Creek drainage. In response, RHR committed to transporting the water to a location outside of the San Mateo Creek drainage for discharge. This pipeline would be placed next to the haul road and the utility corridor in Sections 16, 15, 10, and 11. It would then turn north along the road at the junction with the Section 11 haul road and proceed north through Section 2 (Forest Service lands) and onto private land, as shown on figure 15. An estimated width of 20 feet was assumed to be disturbed during the placement of the pipeline over a distance of 28,919 feet (5.48 linear miles), which totals 13.3 acres, 2.5 acres of which would be on National Forest System lands and 10.8 acres on private land. The pipeline would feed into a new water storage tank to be used for pasture irrigation. As a contingency during overflow periods, water may also be discharged into Laguna Polvadera or San Lucas Arroyo.

RHR proposes to conduct mining operations for a period of approximately 18–19 years, including mine development, operations, and reclamation. The project would start after all required permits have been obtained, including approval by the Cibola National Forest of the mine plan of operations. However, the ultimate mine life of the Roca Honda Mine would depend on uranium market conditions and potential identification of additional uranium ore. Therefore, the ultimate mine life could well exceed 18–19 years.

The following sections summarize the "Roca Honda Mine Plan of Operations, Revision 1" (plan) in relation to three phases of proposed mining activities:

- **Mine Development** includes baseline data gathering, initial site development, construction, and depressurizing activities which would be conducted to facilitate mine shaft construction.
- **Mine Operation** includes activities directly related to production of uranium ore from the underground mine and transport of the ore offsite for mineral processing.
- **Mine Reclamation** includes activities intended to reclaim land affected by mine development and operation, and to return that land to an approved post-mining land use.

Although these activities would generally be performed in sequence, the proposed development, operations, and reclamation activities would overlap to some extent throughout the mine's life. RHR proposes that it would have an archaeologist onsite to monitor all surface disturbance activities undertaken during mine development, operations, and reclamation. The proposed activities are further described in the following sections.

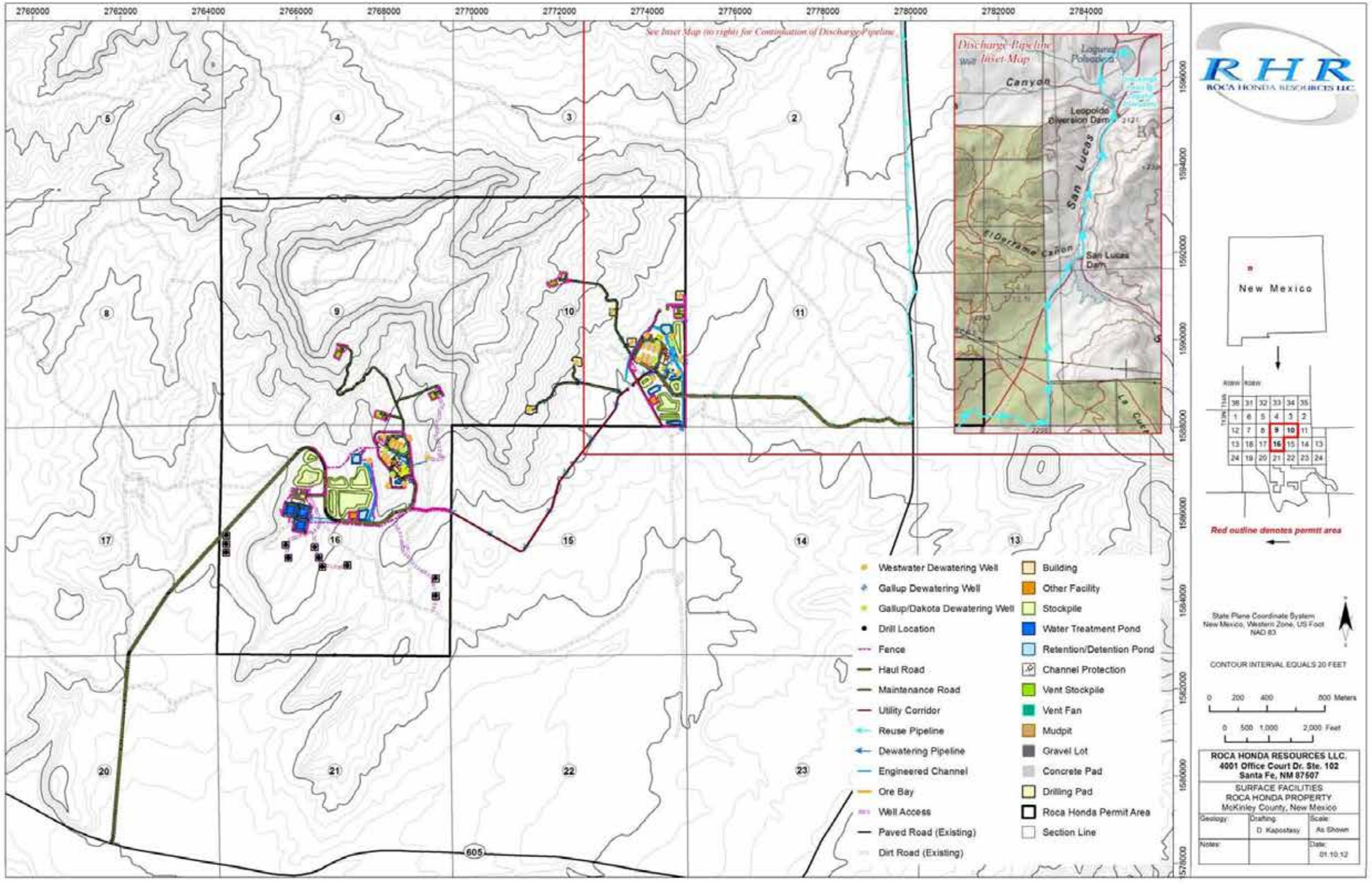

Figure 15. Proposed Roca Honda Mine – layout of surface facilities

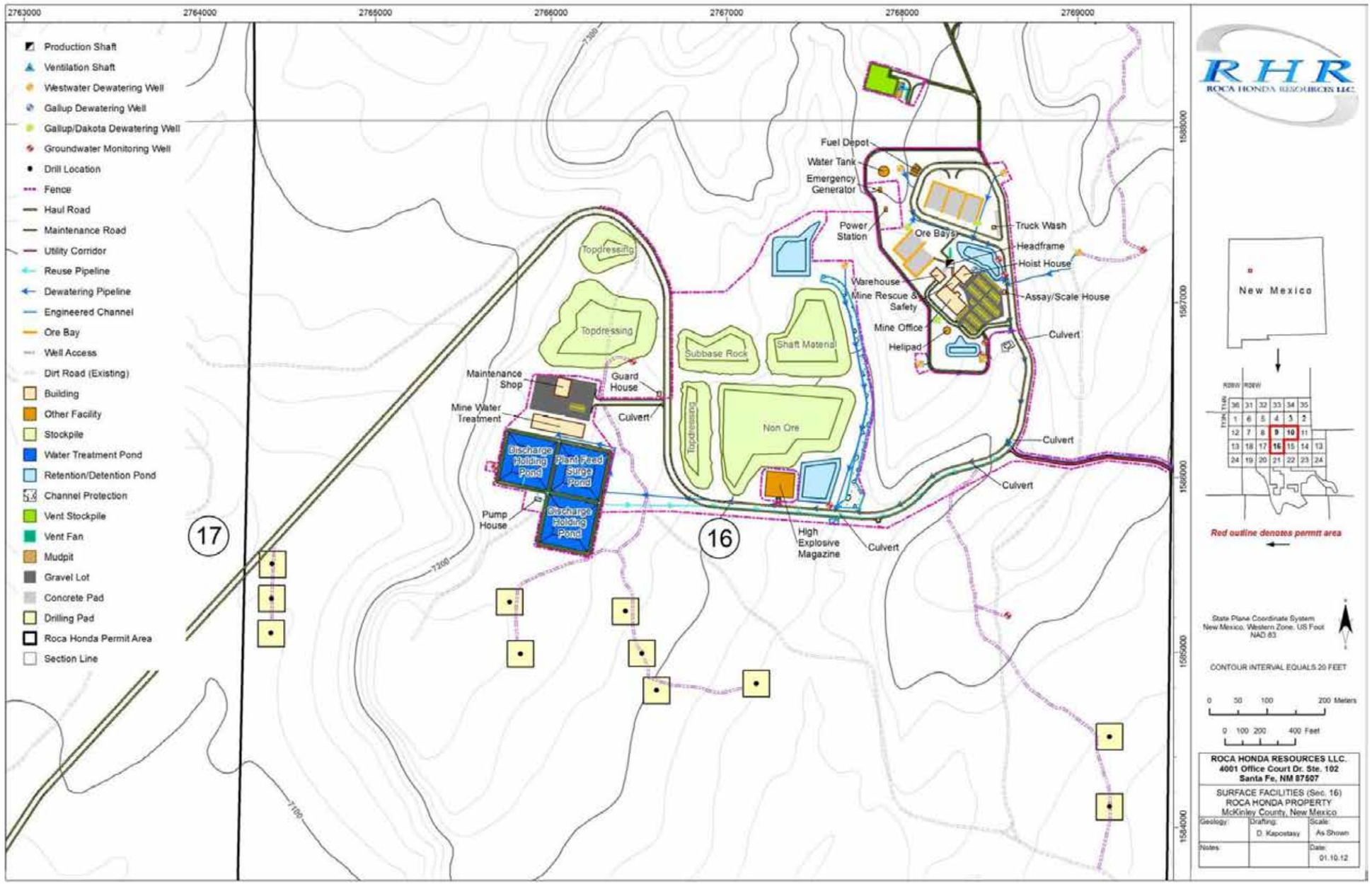

Figure 16. Layout of surface facilities in Section 16 for the proposed Roca Honda Mine

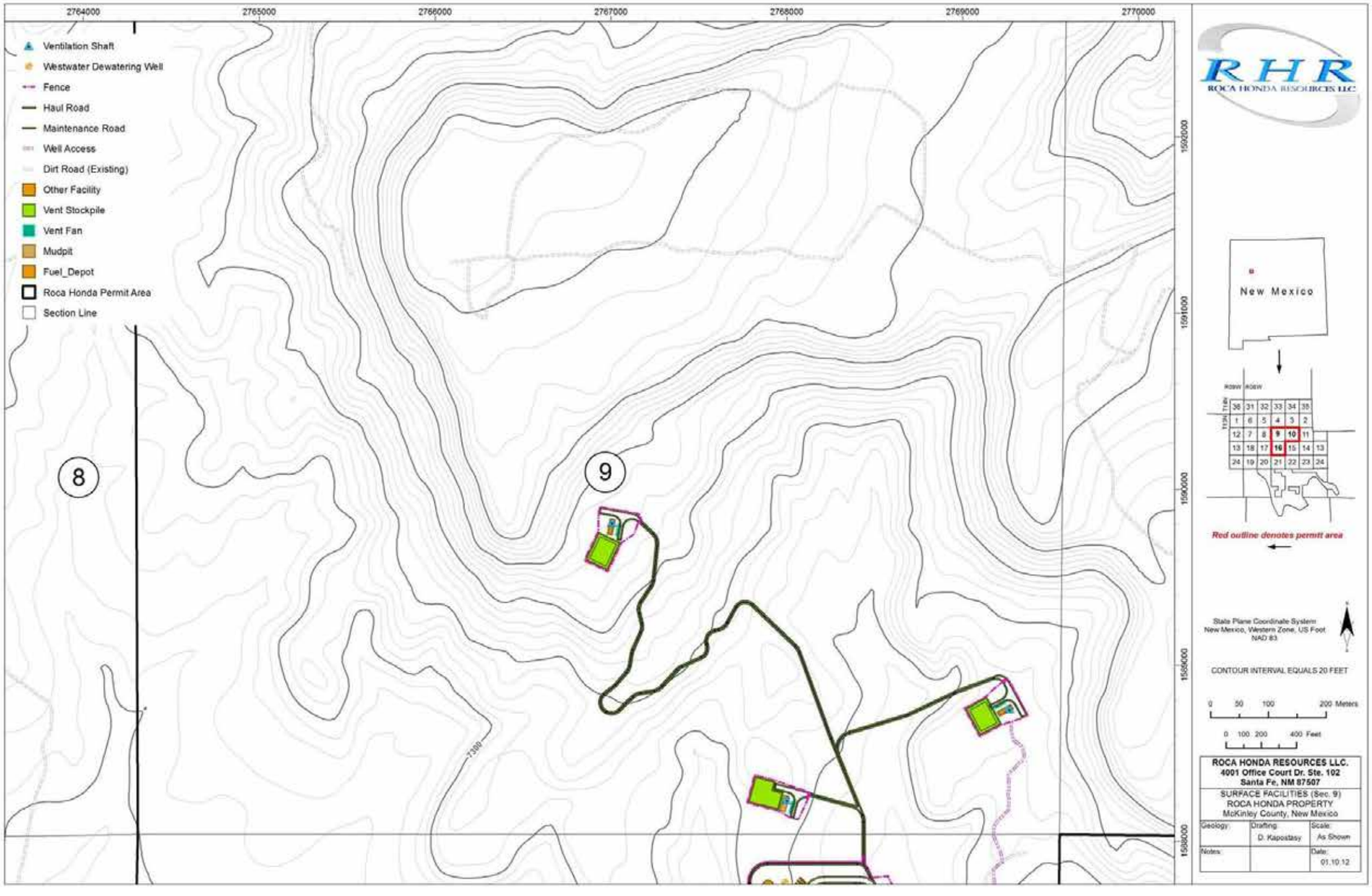

Figure 17. Layout of surface facilities in Section 9 for the proposed Roca Honda Mine

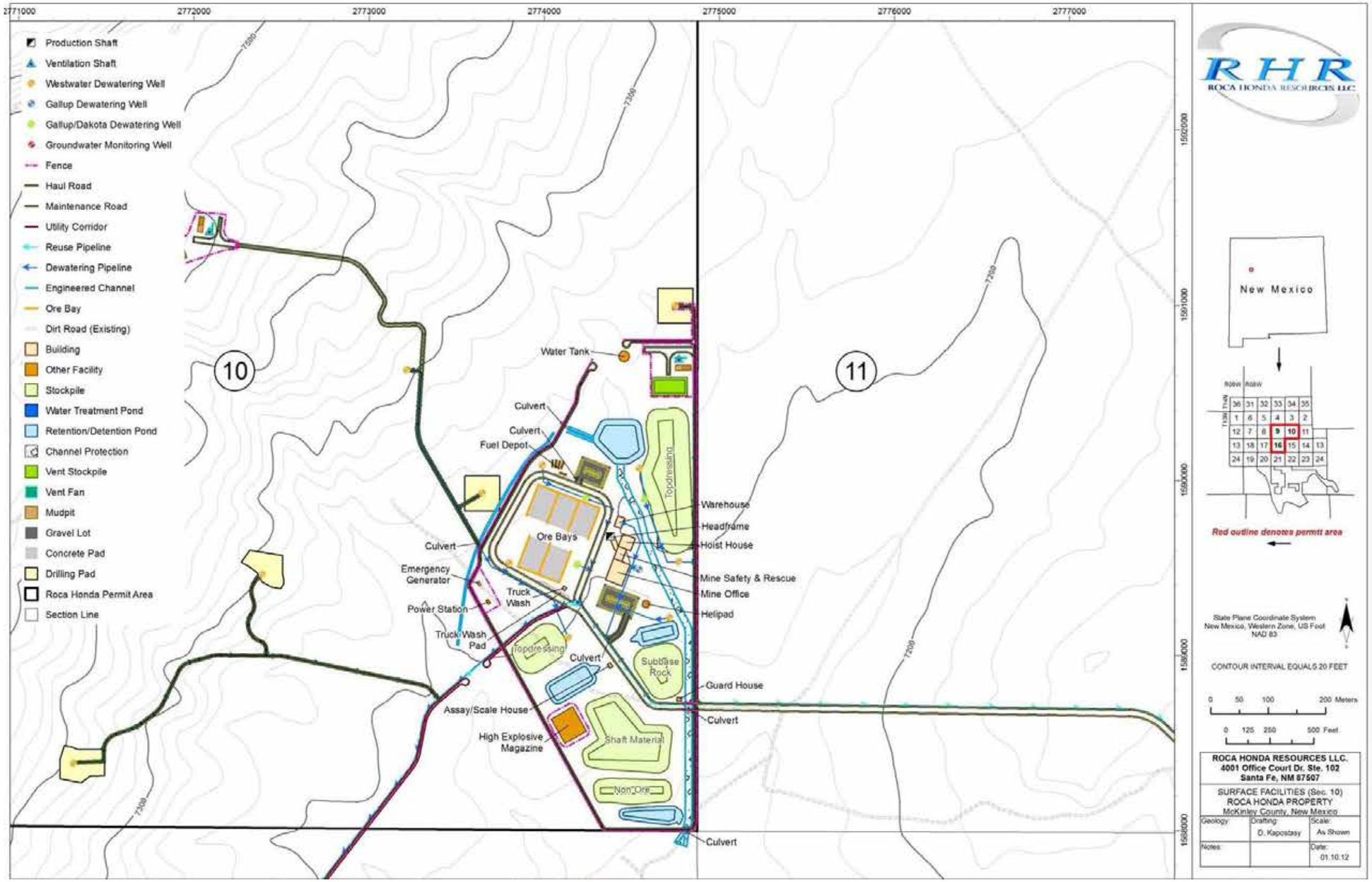

Figure 18. Layout of surface facilities in Section 10 for the proposed Roca Honda Mine

Mine Development

Mine development activities would include gathering of baseline characterization data and construction of depressurizing wells, a water treatment plant, production shafts, ventilation shafts, and ancillary surface facilities. RHR estimates that approximately 3.6 years would be required for development activities before ore production can begin. At that point, the mine operation phase would begin at Section 16 and mine development activities would shift to Section 10 thereafter.

Depressurizing Wells

Artesian aquifers are present in rocks that overlie the uranium ore that RHR proposes to extract. An aquifer is a saturated rock unit with sufficient permeability to provide a significant source of water to wells or springs. An artesian aquifer is one that is under pressure; specifically, it is overlain by a confining bed, such that the pressure causes the water level to rise above the top of the aquifer in a well. As a result, control of potential inflows of water from these artesian aquifers would be critical to facilitate construction of production and ventilation shafts.

Roca Honda proposes to construct 10 water depressurizing wells near the production shaft in Sections 16 and 15 depressurizing wells near the production shaft in Section 10. The sequence described herein would be initiated for the Section 16 production shaft and repeated for the Section 10 production shaft in accordance with the mine development schedule. Four to six such wells would be completed into the Gallup Formation and subsequently deepened into the Dakota Formation. These are the two artesian aquifers that exist above the ore-containing formation, i.e., the Westwater Canyon Member of the Morrison Formation. Six to eight depressurizing wells would be completed into the Westwater Canyon Member.

The purpose of these wells is to reduce water pressure and control groundwater inflows during construction of the shafts. Each well is planned to be 12 to 14 inches in diameter with electric pumps capable of pumping groundwater at a rate of 250 to 500 gallons per minute, for a total dewatering rate of up to 4,500 gpm. The Gallup Formation wells would be operated for a period of time (3 to 6 months) prior to the shaft construction reaching that formation and during the time that it took to complete the shaft through the formation. Thereafter, these wells would be deepened into the Dakota Formation and similarly operated prior to and during completion of the shaft through the Dakota Formation.

The Westwater Canyon Formation wells would be operated from the time they were completed until the production shaft was completed and for a brief period of time thereafter while initial mine development at the bottom of the shaft in the immediate area of the initial mine workings was performed. The anticipated volume of water produced from these wells will vary depending upon the formation being depressurized and the sequencing of events; it is anticipated that the rate of water production will not exceed 4,000 gallons per minute (gpm) at any one time.

RHR also proposes to use pressure grouting to reduce groundwater flow through rocks located in close proximity to the production shafts. Pressure grouting is essentially like filling up the pore spaces of a sponge with grout. It reduces the ability of water to flow through the rock and, thereby, reduces the volume of water that would flow into the production shaft during or after construction. In this process, numerous closely spaced bore holes would be drilled into the rock surrounding the shaft location. Cement grout would be pumped into the drill holes at pressure, and the cement would flow into pore spaces of the rock in the immediate vicinity of the shaft.

The shaft would also be lined to reduce inflow of water from aquifers overlying the underground mine after construction, and to prevent flow of water between aquifers.

During mine operations, mine depressurizing would be accomplished by drilling “long holes” into the rock at the working faces of the mine to drain the formation. The water flowing into the underground mine would be conveyed into underground sumps and would then be pumped out of the mine to the surface through a vertical pipe located within the shaft. Therefore, all of the depressurizing wells would be shut down after construction of the production shafts and initial mine development in the Westwater Canyon Formation is complete.

RHR proposes to plug and abandon most depressurizing wells after shaft construction is complete. However, some may be maintained as long term water quality monitoring wells. The wells would be reclaimed in accordance with State requirements for wells constructed in artesian aquifers.

Water Treatment Plant

Water pumped from the depressurizing wells may produce natural water quality that does not meet numerical surface water discharge standards. Water quality from these wells would be monitored to further develop baseline conditions for each aquifer. RHR proposes to treat water produced from mine depressurization, as necessary, through construction of a water treatment plant. Construction of this plant would be completed within 180 days (about 6 months) after permit approval.

The Water Treatment Plant 60 percent Design Revision 1, as revised to address Agency comments, was submitted in December 2011 (Lyntek, 2011). RHR prepared revision 1 in response to NMED comments on the initial water treatment plant submittal, in support of the discharge plan and MMD permit application. The water treatment facility would encompass approximately 10 acres and would consist of the water treatment process building, an influent surge pond, and two treated water holding ponds. The effluent flow rate is expected to be 2,500 to 4,500 gpm. The maximum design capacity of the treatment facility is 8,000 gpm, which adds redundancy for most treatment units. Water generated from mine dewatering activities, water collected from within the Roca Honda permit area in the retention ponds, and the effluent from the sanitary wastewater treatment system would be treated onsite at the water treatment facility.

The water from the dewatering wells would be pumped to the water treatment plant in a network of 18-inch high density polyethylene (HDPE) pipelines with fused joints. Water from dewatering of the mine proper would be pumped to the water treatment plant in a separate 18-inch HDPE pipeline. This would allow for different options for treatment within the treatment plant based on the influent quality. These pipelines would be monitored for change in pressure utilizing pressure gages throughout the system. In the unlikely event a leak occurred, a specially designed leak-proof saddle would be installed on the damaged area to seal the leak without a pump shutdown. A redundant plan would involve a system of piping and valves to switch the flow of water from one dewater pipeline to the other until the leaking portion of a line can be replaced. This system will be designed as a part of the construction drawings (RHR, 2012).

The water produced from the mine dewatering wells (see the “Water Resources” section) would be pumped to the water treatment facility for treatment prior to disposal. Water produced by the mine would be gathered in a sump located within the mine itself to remove sand and grit. The

water would then be pumped to the surface and delivered to the water treatment plant. The water would be pumped into the reaction tank(s) where barium chloride would be added and any necessary pH adjustment would be made.

Radium would be precipitated and the solution would be pumped to the pressure leaf filters to separate solids from the water. The solids would proceed to the filter press to remove the remaining water. The solids would be bagged for offsite disposal. The filtrate from the leaf filters would then flow to the ion exchange columns, where a selective resin would remove and bind the uranium. The water from the ion exchange columns would be adjusted for pH and sent to the treated water holding ponds and for subsequent discharge in compliance with Federal and State requirements. The resins would be regenerated offsite. The plant is not only designed with some redundant treatment units but it would have piping flexibility to bypass units if they are not needed. The water treatment design package contains a monitoring plan with instrumentation readouts at a logic control panel.

Pipeline

RHR proposes to construct a 20-inch diameter pipeline approximately 5.5 miles in length to transport water produced from the mine offsite (figure 16). The pipeline would be laid on the ground surface so that no trenching or excavation would be required. Almost the entire length would be across private land; a very small portion of Cibola National Forest land would be crossed as well. The proposed destination of the water would be a water storage tank on private ranchland whose owner intends to use this treated water to irrigate range or pastureland for livestock. As a contingency, Laguna Polvadera and San Lucas Arroyo would be utilized for overflow.

This pipeline would be placed next to the haul road and the utility corridor in Sections 16, 15, 10, and 11. It would then turn north along the road at the junction with the Section 11 haul road and proceed north through Section 2 and unplatted lands, as shown on figure 16. An estimated width of 20 feet was assumed to be disturbed during the placement of the pipeline over a distance of 28,919 feet (5.48 linear miles), which totals 13.3 acres, 2.5 acres of which would be on National Forest System lands and 10.8 acres on private land.

Mine Shafts

RHR proposes to mine ore that is located at approximately 1,650 to 2,650 feet below the ground surface. Two production shafts are proposed to access that ore and to provide a means to move workers, equipment, and rock into and out of the mine. A shaft is a vertical tunnel that extends from the surface into the underground mine. Under the proposed action, RHR proposes to construct two production shafts, one located in the northeast quarter of Section 16, and one located in the southeast quarter of Section 10. The production shafts are proposed to be 18 feet in diameter. Development of the Section 16 shaft would occur first, followed by development of the Section 10 shaft. Roca Honda estimates that the Section 16 shaft would be in production approximately 3.6 years after all permits are approved and the Section 10 shaft would be constructed thereafter and in production approximately 8.6 years after all permits are approved.

Mine ventilation is a critical aspect of underground mining. Air must be pumped through the underground mine to provide sufficient fresh air to workers, and to vent or exhaust air from the mine to prevent buildup of contaminants, including radon gas, carbon monoxide, and diesel

fumes. Carbon monoxide and diesel fumes would be generated by mechanized equipment used within the mine to extract ore. Radioactive radon gas, one of the "daughter products" in the decay sequence of U-238 (the most abundant form or isotope of uranium), would be generated by the mine itself as the uranium-bearing rock in the formation is exposed to air when the working faces are opened up in the mine.

RHR is proposing construction of up to five ventilation shafts approximately 9 feet in diameter to facilitate effective mine ventilation at the Roca Honda Mine. Final configuration and location is subject to change depending on conditions encountered at the time of operations. Three of these ventilation shafts are proposed to be constructed in the southeast quarter of Section 9, and two are proposed to be constructed in the northwest and southeast quarters of Section 10.

Secondary escape routes are also critical to facilitate safe underground mining. These secondary escape routes provide a means for workers to escape from the mine in the event of an incident that disabled the production shaft or prevented underground access to the production shaft. Some ventilation shafts would also be designed for use as secondary escape ways.

Radon

Radon is a naturally occurring element with the symbol Rn and an atomic number of 86. The atomic number refers to the number of protons in the nucleus of every atom of a given element. Radon is produced in soil, rock, and water by the natural (radioactive) breakdown, or decay, of two other naturally occurring chemical elements – namely uranium, with an atomic number of 92, and thorium, atomic weight 90.

Rn is a radioactive, colorless, odorless, and tasteless gas. The most stable isotope of radon, Rn-222, has a half-life of 3.8 days, after which half of the original amount has disintegrated into yet another element of the U-238 decay chain, polonium, through radioactive decay, in this case alpha decay (emission of a helium nucleus).

Radon is estimated to cause about 21,000 lung cancer deaths per year, and is the second-leading cause of lung cancer after smoking (EPA, 2010).

Ancillary Surface Facilities

Additional ancillary surface facilities are proposed to support the underground mine operation such as:

- Haul and access roads
- Head frames, hoists, and ventilation shafts
- Soil stockpiles, rock stockpiles, ore pads, and nonore stockpiles
- Fuel, chemical, explosives, and equipment storage areas
- Drill pads to support development drilling and monitoring well construction
- Utility lines, pipelines, storm water control facilities, and fencing.

These facilities would be constructed during the development phase starting with facilities in Section 16 and proceeding to facilities in sections 9 and 10. Major ancillary surface facilities are planned to be constructed in the north half of Section 16 and the southeast quarter of Section 10.

A series of haul roads, mine access roads, and ventilation shaft access roads are proposed to support the mining operation.

After extraction, the Roca Honda ore, like all uranium ore, requires mineral processing to separate uranium from the rock and produce a marketable form of uranium—"yellowcake"—or U_3O_8, the most stable chemical compound or form of uranium oxide. This mineral processing would not be conducted at the Roca Honda Mine. Ore would be shipped from the mine to an offsite mineral processing mill, either an existing mill or a new mill, which would be licensed by and is under the jurisdiction of the Nuclear Regulatory Commission (NRC).

Two existing roads are planned to be rerouted and/or upgraded to provide for ore haulage from the mine to a public highway. The haul road from the Section 16 facilities would lead west from the Section 16 mine site and then south on private land through the east half of Sections 17 and 20. The haul road from the Section 10 facilities would lead east from the Section 10 mine site along the general orientation of an existing two-track road located along the southern edge of Section 11. The haul roads would be 60 feet wide and have a gravel surface. Additional mine access roads are proposed to be constructed in sections 9, 10, and 16.

Head frames, hoists, and fans are surface facilities that service the production and/or ventilation shafts. RHR proposes to install head frames and hoists at the Section 16 and Section 10 production shafts. The head frames would be steel structures, 90 to 120 feet tall, which support the wire rope that lifts workers, equipment, and rock into and out of the mine. The hoist services the shaft and may be located in an adjacent building. Ventilation fans are large fans that may be located at production or ventilation shafts. These fans move air into and out of the mine and provide for a safe working environment underground.

RHR is proposing to install several types of rock and soil stockpiles at the mine. Separate topsoil and subsoil stockpiles are planned to be constructed as the surface facilities are developed. These stockpiles would segregate and protect soil resources for future use during mine reclamation. RHR plans to separately manage and stockpile rock produced during construction of production and ventilation shafts in stockpiles located near the shafts. This material would be either removed to offsite disposal and/or reclaimed onsite.

Once the production shafts reach the rock unit that hosts uranium mineralization—the Westwater Canyon Member of the Morrison Formation—two additional types of rock would be produced, ore and nonore. Ore is rock that contains sufficient concentrations of uranium to profitably extract the rock, truck it to a mineral processing facility, and produce uranium yellowcake. Ore pads are proposed to provide for temporary storage of ore until it is trucked to an offsite mineral processing facility. Nonore is rock mined from the same rock unit as the ore, which may contain slightly elevated, but noneconomical concentrations of uranium. Production of nonore material would be minimized to the extent possible. Initial development of the mine would require that a small amount of nonore material be hoisted to the surface. However, as the mine workings grow, nonore material would remain underground in the mine. RHR proposes to construct separate stockpiles for nonore brought to the surface. This material would be removed offsite over time or placed back in the underground mine workings.

Fuel, chemical, explosives, and equipment storage areas are also proposed to be constructed. Fuel storage areas are proposed to store fuel and other petroleum products. A chemical storage area is proposed to provide for storage of water treatment chemicals. Explosives storage is proposed for blasting agents that would be used within the underground mine. Equipment storage areas would provide for storage of surface and subsurface equipment. These facilities would be located within the Section 16 and Section 10 mine sites.

Drill pads are proposed to be constructed to support development drilling and monitoring well construction. Development drilling requires short-term use of the surface, including a 150-by-150-foot area for drill rig operations, and access roads for transportation of the drill rig and other support equipment. RHR proposes to construct up to12 drill pads to support development drilling. The majority of these drill pads would be located in the southern half of Section 16, with additional drill pads proposed for the northern half of Section 16 and the southeast corner of Section 10. Some drill pads would also be necessary for constructing monitoring wells. Monitoring wells are used to monitor and test groundwater conditions. Roca Honda proposes to construct two monitoring wells in the south half of Section 9 and one in the southeast quarter of Section 10. Temporary access roads in Section 16, 9, and 10 are proposed to provide access to the drill pads. Those drill holes converted to water monitoring wells would have road access for the duration of the mine.

Utility lines, pipelines, storm water control facilities, and fencing are also proposed. These facilities would be constructed primarily in the northern half of Section 16 and the southeastern quarter of Section 10. Storm water control facilities include water conveyances and storm water management structures designed to mitigate potential nonpoint-source water pollution that could be generated at the site.

Figures 16-19 depict the layout of all major surface facilities associated with the Roca Honda Mine.

Additional Construction Commitments

RHR has made the following additional commitments to reduce potential impacts to cultural resources in the permit area.

1. **Roads** – Upon receipt of the necessary permits to allow start of construction, the first activity conducted by RHR would be to blade new access roads within the proposed haul road routes. The new bladed roads would be the access used by all mine related vehicles, while the haul roads are constructed. The existing ranch roads in Sections 17 and 16, and the unauthorized two-track road in Section 11, would not be used for mine related activities. In Sections 9 and 10, new proposed access roads to vent shafts and dewatering wells would be established prior to drilling the shafts and wells.
2. **Section 16 Perimeter Fencing** – Perimeter fencing in Section 16 would be installed at the beginning of construction activities in that section.
3. **Section 10 Perimeter Fencing** – Perimeter fencing in Section 10 would be installed prior to the start of construction of the main mining cantonment area in that section.
4. **Well Pad Fencing and Erosion Control** – For all water monitoring and dewatering wells, including those exploratory drill locations turned into monitoring wells, the well pads would be fenced for the duration of their use, erosion control measures would be implemented around the pad, and a permanent access road to the well would be developed along the route shown on the project maps.
5. **Haul Road Gate** – In Section 11, where Forest Road 192 and the proposed haul road diverge, a gate will be installed across the mine's haul road to discourage public use of the haul road.

Mine Operation

Mine operation includes activities directly related to production of uranium ore from the underground mine. Under the proposed action, these activities would commence first in Section 16, with initial production planned to start approximately 3.5 years after all required permits for the mine are received. At that time, ore production would start in Section 16 and mine development would continue in Sections 9 and 10. Ore production from the Section 10 production shaft is planned to start approximately 8.5 years after all required permits for the mine are received. The production phase would last approximately 13 years. However, the ultimate mine life may be extended if additional ore is identified or if economic conditions change.

Some additional disturbance to surface resources is proposed during mine operation, but most activities would be related to operation of previously constructed facilities, extraction of ore from the underground mine, and shipment of the ore to an offsite mineral processing mill. Major activities during this phase would include:

- Extraction of ore and non-ore
- Placement of ore on ore pads, truck loading, hauling
- Depressurizing and treatment of mine water
- Transportation of mining supplies and personnel to and from the mine

Extraction of ore would use drilling, blasting, and excavation to construct a network of underground tunnels and rooms. Ore would be blasted, loaded in underground mine haulage equipment (figure 19), and hauled to the surface through the production shaft. The ore would then be placed on the ore pad for temporary storage until it was loaded onto a highway haul truck. The ore would then be hauled from the mine on one of the haul roads to an existing public highway.

Continued depressurizing from the mining area is expected throughout the production phase using long-hole drilling techniques as previously described. Water that flows into the underground mine would be collected in sumps and pumped to the surface through the production shaft. Because groundwater within the mine is in close association with uranium ore, it may contain elevated levels of uranium or other elements. The mining operation itself may also affect the solubility of uranium or other elements within the mine water as the mine workings are developed. RHR proposes to treat water removed from the mine in the water treatment plant described above for the duration of the underground mine operation. Treated water would then be piped onto a private ranch northwest of the mine site via the pipeline described above.

Transportation of mining supplies and personnel to and from the mine would occur throughout the production period. Mining supplies such as fuel, blasting agents, and supplies for water treatment would require transport to the mine. Mine workers would also travel to and from the mine during the production period. In addition, materials such as used petroleum products and solid wastes would require transport from the mine. These personnel and materials would be transported using the mine haul roads.

Figure 19. Uranium mine tunnel and haul equipment at Mining Museum in Grants

Mine Reclamation

Mine reclamation would be the last phase of the proposed operation. Mine reclamation is designed to reclaim the effects of mining and achieve a post-mining land use of grazing. Most reclamation would occur after mining is complete, because major surface facilities are planned to be used for the life of the underground mine. This type of reclamation is termed final reclamation. RHR estimates that the life of the mine would be approximately 18–19 years. Final reclamation would be complete at that time. Some contemporaneous reclamation is planned, which is reclamation that would be conducted during the development or operations period.

RHR initially presented general reclamation concepts in "Reclamation Plan for Roca Honda Mine" (Roca Honda Resources, 2009b). However, revision 1 of the plan contains more detailed reclamation designs. Forest Service regulations at 36 CFR 228.13 require a mine operator to furnish a reclamation bond before a plan of operations is approved. The purpose of the reclamation bond is to provide for reclamation of mining-related disturbance in the event that RHR does not reclaim the mine. The regulations require that the amount of the reclamation bond be based on "the estimated cost of stabilizing, rehabilitating, and reclaiming the area of operations." The following section summarize RHR's proposed reclamation plan.

Contemporaneous Reclamation

Contemporaneous reclamation is reclamation that would be conducted during the mine development and/or operations phases. RHR would implement contemporaneous reclamation to the maximum extent practicable. Nevertheless, in an underground mining operation such as the proposed action, opportunities for contemporaneous reclamation are limited compared to a

surface mining operation. Many of the areas that would be disturbed early in the project would remain disturbed until mine closure and reclamation. Since the majority of activity would take place thousands of feet below the surface, a relatively small percentage of project operation affects surface resources (RHR, 2012).

As described above, surface disturbances would consist of the administrative buildings and support facilities, water treatment plant and ponds, excavation material stockpiles, roads, utility corridors, surface water flow channels and detention basins, retention ponds, and other facilities. Most of these areas must remain as constructed and functional until mining operations cease and final site reclamation begins. However, since Roca Honda mining would be split between Section 16 and Section10, some contemporaneous reclamation would begin to the extent possible in Section 16 on facilities and areas not required for the mining efforts in Section 10.

The overall approach to contemporaneous reclamation is to avoid site disturbance wherever possible and minimize the area that must be disturbed. Contemporaneous reclamation would be initiated with soil salvage and interim revegetation, and would continue through mine operations with protection and maintenance of excavation material stockpiles, closure of wells, and reclamation (revegetation) of drilling pads when they are no longer needed. This early reclamation would minimize erosion, while isolating and protecting material for later use; it would provide for mitigation of potential effects and reduce the final reclamation work and costs (RHR, 2012).

Contemporaneous reclamation would also involve avoidance of disturbance and the use of existing roads and access corridors whenever possible. For example, there are a number of previously disturbed sites within the permit area consisting of historic drill pads and existing dirt roads. RHR would improve some of these existing roads for its needs and locate ventilation holes and escape shafts on old drill pads whenever possible. Candidate areas for contemporaneous reclamation include the mud pits, development drill pads, and the excavated material stockpiles, which consist of: (1) topdressing, (2) subbase rock, (3) shaft material, and (4) nonore material.

Final Reclamation

Final reclamation is designed to remove surface facilities, plug the mine shafts, recontour the disturbed area, replace stockpiled soil, and establish vegetation suitable for the post-mining land use of grazing. The reclamation approach was initially presented in the reclamation plan for Roca Honda Mine (Roca Honda Resources 2009b); this plan was subsequently revised in response to input from State agencies.

In general, final reclamation would include the following components:

- Survey the disturbed area and ore haulage routes for uranium-bearing materials, and develop a plan to excavate and dispose of any affected soil.
- Remove salvageable equipment and any hazardous or toxic substances from the underground mine.
- Place concrete plugs at surface openings and plug extraction and monitoring wells.
- Remove water, sediments, and pond liners from storm water evaporation ponds and regrade to match surrounding terrain.

- Decommission water treatment plant and water storage ponds including removal and disposal of remaining chemicals or other hazardous substances.
- Remove storm water control structures such as detention basins and arroyo armoring.
- Remove surface mine facilities, provide for reuse or dispose as appropriate.
- Recontour areas of surface disturbance to provide for positive drainage and slope stability.
- Remove road base material and reclaim roads that are not planned to be retained by surface landowners.
- Spread stockpiled topsoil on recontoured areas, revegetate with native seed mixture designed to facilitate post-mining land use of grazing, and implement erosion control measures.
- Remove perimeter fences.

RHR proposes reclamation performance standards that would be used to assess growth of grasses, forbs, and woody species in reclaimed areas. These reclamation performance standards would assist in evaluating reclamation performance and achieving release of the mine reclamation bond after reclamation is complete.

In response to Agency comments on the initial reclamation plan, RHR submitted revision 1 in August 2011. Revision 1 revised and updated the original 2009 reclamation plan. Revision 1 contains a detailed discussion of the steps that would be taken to stabilize and configure the site so as to achieve the approved grazing post-mining land use. These steps, which are consistent with State regulations at NMAC 19.10.6.603.D (1 through 5), are summarized below.

Final slopes and drainage configurations would be constructed to conform with the geomorphic character of the region and surrounding area, and would be compatible with the approved post-mining land use of grazing.

Impoundments, roads, and other depressions would be backfilled, as described in the reclamation plan, revision 1 to meet stability requirements and the geomorphic character of the region and surrounding areas.

Prevention of mass movement of reclaimed slopes, embankments, roads, or other fill areas would be achieved through the construction of fill areas in lifts of 24 inches or less, with the addition of water, and the areas wheel rolled to achieve compaction. Since the areas will not be required to support any structures or weight other than overlying material, these procedures will be adequate to prevent mass movement.

The soil and rock stockpiles would be used as part of the final reclamation for fill and vegetation growth. No stockpiles would remain on the surface in the permit area after final reclamation.

Given the expected geochemical properties of the excavated and stockpiled overburden, the potential for acid and other toxic drainage is believed to be inconsequential. However, RHR would characterize the excavated materials as a part of the NM Mining Act Baseline Data Report in addition to the NMED Discharge Plan process. These excavated materials would be analyzed to determine their potential for release of acid or other toxic constituents. Material excavated during construction of the mine shafts and vent holes would be temporarily stored in designed

stockpiles to prevent mass movement and protected from storm water runoff. If the material is inert, it would be returned to the mine and used to backfill areas for stability during mining.

Alternatively, if the analytical results indicate that acid producing or other toxic constituents could be leached, the material would be loaded in haulage trucks and taken offsite for disposal. Runoff from these stockpiles would be collected in storm water retention ponds. The water would be pumped to the onsite water treatment plant before it is discharged. The bottom sediment from the ponds would be analyzed for constituent makeup and disposed of appropriately in an offsite facility. Thus, any material with the potential to release acid or other toxic drainage would not be on the permit area after reclamation (RHR, 2012).

Sufficient material has been identified to restore a vegetative community that would support the approved post-mining land use of livestock grazing. Topdressing that has been stockpiled for more than 1 year would be analyzed to determine if soil amendments are necessary to support successful reclamation of disturbed areas. RHR commits to the addition of mycorrhizal inoculum for all topsoil materials stockpiled at depths greater than 2 feet from the surface.

As part of reclamation operations, disturbed areas would be stabilized through grading areas to conform to the geomorphic character of the region and surrounding area, including shaping, berming, and grading to final contour. Reclamation of slopes would incorporate the practice of minimizing slope lengths and gradients, while conforming to the geomorphic character of the region and surrounding areas to minimize the potential for excessive erosion. Both runoff and runon (water entering a site) would be diverted from reclaimed areas to prevent erosion of those areas. The reclaimed slopes would be protected using best management practices (BMPs) to reduce erosion into these diversion channels. If a channel has the potential to erode into a reclaimed slope, the bank would be armored temporarily until the reclamation project has been approved. The reclaimed areas would be monitored for erosion until stabilization and revegetation has been achieved. Any areas of major erosion discovered during this monitoring would be repaired, stabilized, and revegetated (RHR, 2012).

With regard to revegetation, salvaged topdressing would be redistributed over regraded areas, amended with mycorrhyzae and organic fertilizers, and then seeded using native, adapted species characteristic of the region and supportive of livestock grazing. The proposed seed mix in table 2 is used at the nearby Lee Ranch Coal Mine, which has similar topography, soils and climatic regime. It has shown to be effective over more than 30 years, and is a mixture of cool and warm season species of grasses, forbs, and shrubs that have demonstrated ability to reestablish in mine reclamation soils and also to support livestock grazing. All species are known for their palatability to livestock and wildlife, are high in nutritive value for native plant species, and have differing seasonal value between species, which makes the mix supportive of the post-mining land use of grazing on a year-round basis (RHR, 2012).

Table 2. Proposed reclamation seed mix for the Roca Honda Mine

Common Name	Scientific Name	Variety/Source	Application Rate*
Cool Season Grasses			
Thickspike Wheatgrass	*Agropyron dasystacyum*	Critana	2.0
Western Wheatgrass	*A. smithii*	Arriba	3.0
Warm Season Grasses			
Blue Grama	*Bouteloua curtipendula*	Hachita or Alma	2.0
Sideoats Grama	*B. gracilis*	Niner or Vaughn	2.0
Galleta	*Hilaria jamesii*	Viva	3.0
Alkali sacaton	*B. curtipendula*	Native	0.1
Forbs			
Munro Globemallow	*Sphaeralcea munroana*	Native	0.4
Blue Flax	*Linum lewisii*	Appar	0.5
Violet Prairie Clover	*Dalea purpurea*	Native	2.0
Shrubs			
4-Wing Saltbush	*Atriplex canescens*	Native	3.0
Winterfat	*Ceratoides lanata*	Native	1.0
Shadscale	*A. confertifolia*	Native	1.0

* Pure live seed lbs per acre (broadcast)

Alternative 3 – Require Modified Plan of Operations (One Shaft Alternative)

Under this alternative (figure 20), the Cibola National Forest supervisor would require RHR to locate most surface facilities and infrastructure associated with the Roca Honda Mine onto Section 16. The production shaft and associated facilities located on Section 10 in the proposed action (alternative 2) would be eliminated in this alternative. The facilities that would be eliminated from Section 10 under alternative 3 duplicate those proposed in alternative 2. The purpose of the Cibola National Forest supervisor requiring this change in the plan of operations would be to reduce the overall acreage of surface impacts from the mine itself by about one-third (from 183 acres to 120 acres).

In the one production shaft alternative, all ore production from the RHR Mine would be achieved by constructing only a single production shaft on State-leased lands in Section 16, i.e., the shaft described in RHR's proposed action. All of the ore in the permit area would be accessed by excavating underground mine declines horizontally under the ore and vertical raises up into the ore pods. In this alternative, the ore located in Section 10 would be accessed by constructing two long parallel development drifts from the Section 16 shaft northwest into Section 10 to the

approximate location where the Section 10 production shaft described in the proposed action would have been constructed (Velasquez, 2011).

Development and subsequent production of this one production shaft scenario would result in a substantially reduced "footprint" of surface disturbance on Section 10 than that described for the proposed action. While RHR identified that the proposed action would disturb 71 acres of land surface on Section 10, the one production shaft alternative would disturb approximately 18 acres in Section 10.

As shown by comparing figure 20 with figures 15-18, all of the surface facilities described by RHR in Sections 16 and 9 for the proposed action would remain in place, with the exception of the location of one of the ventilation shafts. In the one production shaft alternative, the northernmost ventilation shaft in Section 9 and its attendant access road would be eliminated.

This would also result in a surface disturbance of approximately 2 acres in Section 9 rather than the 12 acres identified in the proposed action. In total then, implementation of the one shaft alternative would result in a reduction of surface disturbance of approximately 63 acres, mainly in Section 10.

In the one production shaft alternative, a new ventilation shaft would be constructed in the northeast corner of Section 16. The location of the new ventilation shaft would be accessed via the well access road identified in the proposed action leading from the ventilation shaft located in the southeast corner on Section 9 south to the existing monitoring well in the northeast corner of Section 16.

In Section 10, the production shaft and attendant supporting surface facilities described in the proposed action, except as described below, would be eliminated. All of the buildings including the hoist house, office (including the miners changing facilities, mine safety and rescue, and administrative offices), explosives magazine, assay/scale house, security building, and warehouse would be eliminated. Other structures, including the ore bays, truck wash, power substation, water tank, fuel depot, and emergency generator would also be eliminated. The nonore, shaft material, subsoil, subbase rock, and topsoil stockpiles would all be eliminated. Other surface disturbance manifestations including the mine dewatering wells around the perimeter of the production shaft, the three evaporation ponds, the detention basin, the helipad and parking lot, and the site perimeter fencing would all be eliminated as well (Velasquez, 2011).

The surface facilities remaining in Section 10 in the one production shaft alternative would include the single mine development drill hole, the two ventilation shafts, and the utility and mine dewatering discharge pipeline corridor described in the proposed action. The one production shaft alternative would also require some modifications and additions in Section 10. The two ventilation shafts identified in the proposed action would be relocated as shown on figure 20 to an area roughly coincident with the northeasternmost end of the underground development drift described above. This would provide fresh air into that area of the mine to replace air that would have otherwise been provided by the Section 10 production shaft identified in the proposed action.

Also, two additional ventilation shafts would be constructed generally along the path of the underground development drift. One would be located in the southwest corner of Section 10 as shown on figure 20. The other would be located approximately 200 feet north of where RHR's proposed action identifies the location of the development drill hole proposed in Section 10.

One of the six dewatering wells in figure 20 is at the same location as the proposed development drill hole. The drill hole would be completed first and then converted to a mine dewatering well. To accommodate the one production shaft alternative, this well would be converted at a later date to a backfill material transport access hole from the surface into the mine through which engineered backfill material would be introduced by gravity into the mine. This area would require a surface work area footprint larger than the typical dewatering well pad, i.e., approximately the same size as the footprint of the ventilation shaft. The surface disturbance footprint of the typical dewatering well would be less than an acre. The anticipated surface disturbance footprint of the backfill hole would be approximately 5 acres, sufficient to accommodate backfill material stockpiling and equipment. In addition, because this area would be the receiving point for imported backfill material, the access road through Section 11 into Section 10 would be needed in the one production shaft alternative. While the purpose of use and length of the haul road would differ from the proposed action, the road would still be constructed up to the location of the backfill hole.

Under this alternative, the overall volume of materials mined (ore and nonore) and the configuration of underground mining tunnels and rooms within the ore-bearing Westwater Canyon Formation would not differ substantially from the proposed action. In other respects as well, the modified plan of operations alternative would be essentially the same as the proposed action. Thus, the description of the three phases in the proposed action—mine development, mine operation, and final reclamation—is applicable to this alternative as well, except that mine development and operation would be more limited to State lands on Section 16 and avoid most of the disturbance to surface lands in Cibola National Forest on Sections 9 and 10.

Project-Specific Forest Plan Amendment

Before either could proceed, alternative 2 and alternative 3 would both require approval by the Cibola National Forest supervisor of a project-specific amendment to the Cibola National Forest plan. The land and resource management plan, in force since 1985, guides management decisions concerning the Cibola National Forest and its resources. Among many other topics, the plan includes standards for the treatment of historic properties on lands managed by the Cibola National Forest. These standards only apply to lands and resources managed by the Cibola National Forest. With regard to the proposed project and its potential for impacts on historic properties, it is important to note the following:

- Standard No. 4 states that historic properties “will be managed during the conduct of undertakings to achieve a ‘no effect’ finding in consultation with the SHPO and the Advisory Council on Historic Preservation.” (USFS, 1985:63)
- Standard No. 5 addresses instances where resource management conflicts occur. It gives a list of conditions under which “preservation of cultural resources in place will be the preferred option.” These conditions include:

  Where the cultural values derive primarily from qualities other than research potential, and where those values are fully realized only when the cultural remains exist undisturbed in their original context(s) (e.g., association with significant historical persons or events, special ethnic or religious values, or unique interpretive values). (USFS, 1985:63)

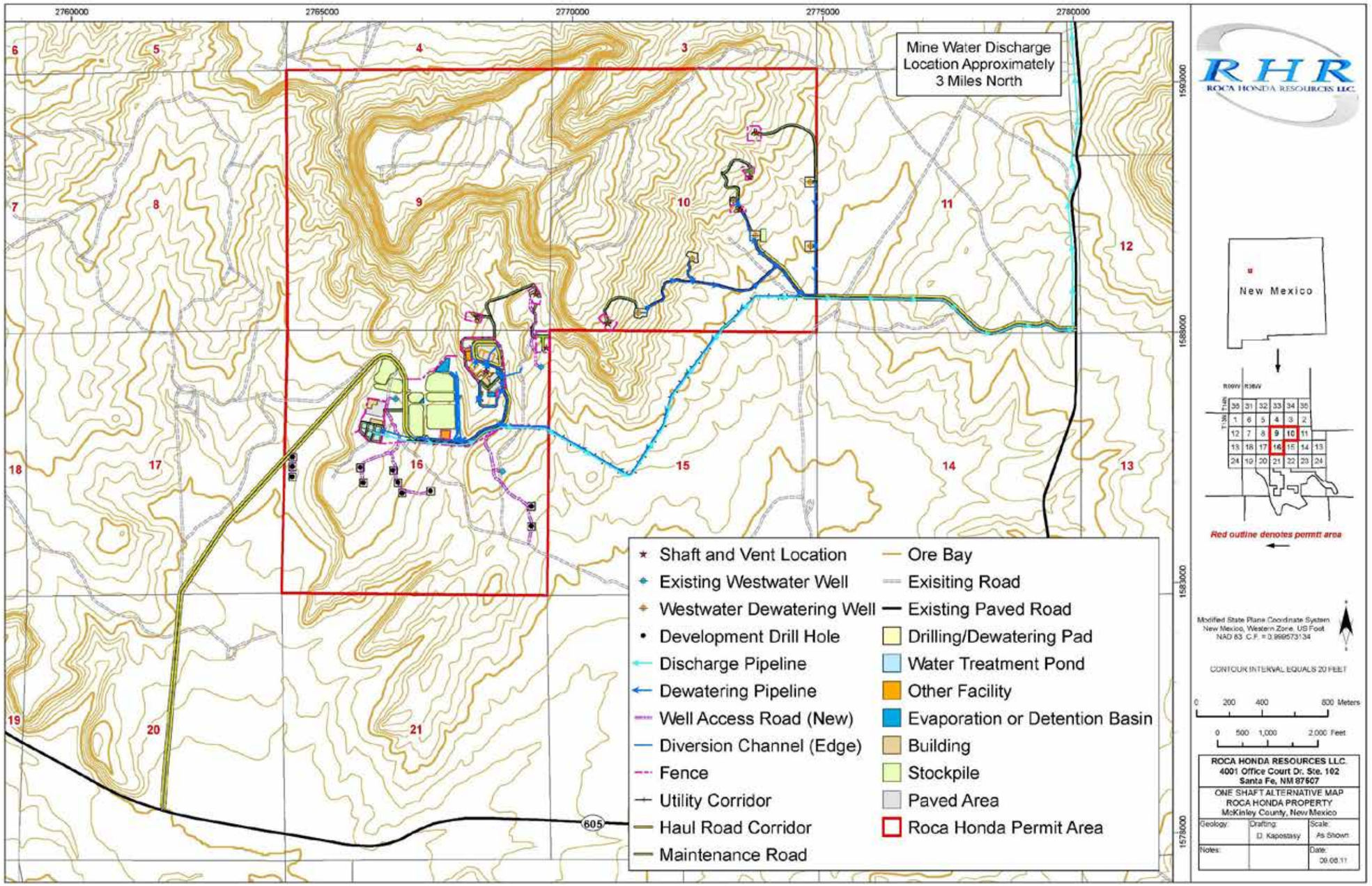

Figure 20. Layout of surface facilities under alternative 3 (one productive shaft alternative)

If this EIS concludes that alternative 2 or alternative 3, or both, were to result in adverse effects to historic properties on Forest Service lands, then selection by the Forest Service of that alternative would be in conflict with these two standards of management for historic properties. Thus, the Forest Service would approve a project-specific forest plan amendment to allow the Roca Honda project to deviate from the forest plan standards of management with regard to historic properties identified above. This amendment would only apply to the Roca Honda Mine project and only to the standards of management with regard to historic properties. The amendment would allow impacts to historic properties resulting from this project, in accordance with normally applicable law, e.g., Section 106 of the NHPA and 36 CFR Part 800.

Mitigation Common to All Alternatives

The Forest Service also developed the following mitigation measures to be used as part of all of the action alternatives. These mitigation measures complement and, to some extent, overlap with draft commitments and measures submitted by RHR to the Forest Service and the State of New Mexico regulatory and resource agencies in the draft mine operations plan, new mine permit application (to MMD), and other documents. With regard to the Forest Service and RHR, mitigation measures will not be finalized, and will not represent firm commitments, until the mine operations plan is approved after the final EIS and record of decision are issued.

The list below is organized by resource topic in the following EIS.

Geology and Soils

- Implement best management practices (BMPs) for erosion control.
- Prepare and implement Storm Water Pollution Prevention Plan (SWPPP) in compliance with EPA and State of New Mexico requirements.
- Implement soil control measures detailed in the mine reclamation plan.
- Examples of measures include using straw bales, wattles (fences of stakes interlaced with twigs or branches), and silt fencing to minimize the transport and loss of soil from erosion and storm runoff; installing sedimentation control structures prior to construction; minimizing the area that must be disturbed; and conducting contemporaneous reclamation during operations.

Water Resources

Surface Water

- Implement BMPs for storm water control.
- Prepare and implement SWPPP.
- Implement storm water controls as detailed in the mine operations plan.
- Implement storm water and erosion controls detailed in the reclamation plan.
- Examples of measures and controls committed to in the plans include installation and implementation of runoff control devices (swales, ditches, fiber mats, and fiber rolls), energy dissipaters, slope drains, sediment traps, evaporation ponds, diversion channels, detention basins, stockpile slope construction, stockpile soil cover, and revegetation.

- Water impoundments constructed onsite would include storm water detention ponds, evaporations ponds, and settling ponds. These ponds would be lined and monitored.
- Construction, operation, and restoration of the mud pits at drilling locations would be in compliance with the Pit Rule (19.15.17 NMAC).
- Some of the arroyos that transect the operational area would be armored or straightened.
- Discharges to surface water courses would be monitored.

Groundwater

- Implementation of offsets (mitigation measures) as defined by NMOSE through the permitting process.
- Discharge plan would include measures to prevent soil water logging or increased flood runoff.
- Mine backfill materials would be mixed with cement prior to placement.
- Implementation of controls as detailed in the Groundwater Discharge Permit (in review by NMED).
- Implement proposed monitoring program to include routine inspection of operating and storage areas, instrumentation of key equipment (as an example, pressure sensors on discharge pipelines), and installation of monitoring wells for overall monitoring of the process areas, including components that do not include leak detection systems per se—for example, the lined retention ponds that drain the stockpiles.

Air Quality

- Implement BMPs to control for fugitive dust.
- Water would be used to control fugitive dust emissions from blasting, drilling, and surface disturbance. Ore stockpiles and waste rock stockpiles would be sprayed with water to minimize the amount of dust generated during loading operations.
- Fuels, explosives, and chemical storage would comply with any applicable fuel storage and fuel dispensing air quality regulations.

Vegetation

- Implement BMPs for storm water control and erosion control.
- Revegetation design would follow the reclamation plan.

Wildlife

- Implement BMPs for control of storm water, erosion, and fugitive dust.
- Conduct periodic inspections of mining activities.
- Implement measures outlined in the mine operations plan. These include:
    - The maximum speed limit on the mine permit area would be posted at 15 miles per hour and signs would be posted along access roads to and around the permit area alerting drivers to the presence of wildlife.

- Fences would be placed around mine shafts and ventilation holes to keep wildlife out of these areas, and screens would be placed over ventilation openings to deter birds and bats.
- Power lines and associated equipment such as transformers and substations would be built using BMPs for raptor safety.
- Appropriate avoidance and minimization measures would be developed in consultation with the Forest Service to address migratory bird nests discovered during mining operations.
- Pruned and felled trees would be scattered to provide cover, where appropriate. Also when trees are chopped, the mulch would be spread onsite in open areas away from personnel traffic.

Land Use

- Implement BMPs for control of storm water and erosion.

Recreation

- None.

Environmental Justice and Protection of Children

- A spill prevention, control and countermeasures (SPCC) plan would be developed to train workers and employees on handling hazardous substances, prevention of spills, cleaning up spills, emergency or accidental releases, and the notifications and reporting requirements.
- Access to the permit area will be controlled during mining operations to protect the public from possible injury due to operating conditions such as heavy equipment and truck traffic and other operations that have the potential to cause injury to untrained personnel.
- All personnel entering the site will be checked in and allowed access to the administration building only with a company escort.

Socioeconomics

- None.

Cultural and Historic Resources

- Implement BMPs for storm water and erosion control.
- Implement a programmatic agreement (to be developed between the draft EIS and final EIS) that contains measures to avoid, minimize, and mitigate impacts to cultural resources.
- Implement additional facility commitments: initial blading of access roads within proposed haul road routes, perimeter fencing of Sections 10 and 16, well pad fencing and erosion control, and installation of a gate on Section 11 haul road.

Visual Resources

- None.

Transportation

- Implement BMPs as described in the mine operations plan.
- Place construction staging areas where they would least interfere with traffic. All vehicles associated with mine development would be equipped with backing alarms, two-way radios, and slow moving vehicle signs when appropriate. Ore hauling trucks would be placarded and covered with tarps.

Human Health and Safety

- Implement company safety manual that outlines training and sets forth policies and requirements for safe driving procedures such as onsite speed limits and no tolerance of drug or alcohol use.
- Workers would shower and change clothes before leaving the mine facility, and work clothes would remain at the facility to be washed.
- All trucks carrying ore materials would be sprayed down before leaving the site at the vehicle washing station located onsite.
- Implement a detailed SPCC plan to train employees on safety procedures (see the mine operations plan for details).
- Implement best practices for waste management.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the proposed action provided suggestions for alternative methods for achieving the purpose and need. Some of these alternatives—such as developing renewable resources like wind and solar instead—were outside the immediate scope of the proposal. The Forest Service's purpose and need regarding this project is to respond to the proposal to exercise Roca Honda's statutory rights to enter public lands and mine these particular claims.

Renewable Energy Development

Development of renewable energy sources (such as wind and solar) on Cibola National Forest or elsewhere in the region, as an alternative to mining uranium at the Roca Honda site, will not be considered in this EIS. While such projects may well have merit and be worth pursuing in their own right—and indeed are being developed in the area, such as the 102 MW Red Mesa Wind Energy Center in Cibola County (near Bibo)—they do not meet the Forest Service's purpose and need as defined above.

Treated Water Discharge in an Alternative Location

This alternative was the original proposed action at the time of scoping in December 2010, under which the Roca Honda Mine would have discharged treated groundwater from the mine into an unnamed arroyo on Section 16. It was eliminated because, according to expert opinion, its potential impacts on water resources would be difficult to ascertain without lengthy, costly, and possibly inconclusive investigation, and these effects could possibly be moderate to major, as well as controversial.

This unnamed arroyo (figures 21 and 22) is characterized by ephemeral or intermittent flows (i.e., it is dry most of the time), and it is tributary to San Mateo Creek. Discharging up to 4,000 gpm of treated water into the arroyo would have changed its flow regime from ephemeral to permanent for the duration of the mine.

This alternative, in other respects identical to the current proposed action, was complicated by the presence of legacy environmental effects from previous eras of uranium mining and milling in the San Mateo Creek watershed. These legacy effects made evaluation of potential environmental effects of the proposed Roca Honda Mine discharge much more difficult (Nelson, 2011).

Groundwater pumped from the mine would have been treated as necessary to meet an NPDES permit prior to discharge into a tributary to San Mateo Creek. However, legacy mine water discharges from historic uranium mining and milling operations are suspected of causing contamination in sediments and alluvium in the San Mateo Creek watershed downstream of the proposed Roca Honda Mine discharge. Discharge of treated water meeting NPDES standards could potentially “rinse” these potential legacy contaminants from sediments and unconsolidated alluvial sediments within the San Mateo Creek watershed, and transport these contaminants into surface water or groundwater.

Figure 21. Arroyo originally intended to receive treated water from Roca Honda Mine at approximate point of discharge

Figure 22. Bottom of same unnamed arroyo originally intended for water discharge

Here, the term “rinse” refers broadly to various water–rock interactions that could result in transfer of potential legacy contaminants from the solid phase to the dissolved phase. Dissolved solids discharged in mine water from legacy operations may have been sequestered into the sediments and alluvium of San Mateo Creek though mechanisms such as adsorption of dissolved solids to mineral surfaces, mineral co–precipitation, or ion exchange reactions. Although these mechanisms would have sequestered contaminants from the discharged mine water into the solid phase, such reactions are reversible to some extent. Treated water discharged from the Roca Honda Mine could potentially cause rinsing of legacy contaminants through desorption or ion exchange reactions. The processes could lead to mobilization of potential legacy contaminants from the solid phase to the dissolved phase, and cause adverse effects to surface or groundwater quality downstream from the mine (Nelson, 2011).

Another consideration related to legacy pollution that affected the viability of this alternative is the presence of a former uranium mill site downstream from the proposed Roca Honda Mine discharge. At this site, the Homestake Mining Company Mill Superfund Site, groundwater contamination occurs within the San Mateo Creek alluvial aquifer, and groundwater remediation is currently in progress. Groundwater contamination within the San Mateo alluvial aquifer is also reported to be present downgradient (southwest) from the Homestake Mill (NMED, 2010), and up–gradient from the Homestake Mill. This up–gradient contamination is attributed to still other legacy mines and mills in the Ambrosia Lake District.

During scoping, State agencies and members of the public raised concerns about the possible interaction between the Roca Honda Mine and legacy contamination. Ultimately, due to these various complications and uncertainties, RHR voluntarily changed their proposal and the

interdisciplinary EIS team dropped this alternative from detailed consideration, and replaced it with what is now the proposed action.

Single Production Shaft in Section 10

The interdisciplinary team considered, but dismissed from more detailed analysis, the option to construct a single production shaft in Section 10. In this alternative, all of the ore in the permit area would be accessed by excavating horizontally underground from this shaft to the ore deposits. All of the facilities planned for Section 16 under the proposed action would be constructed instead in Section 10. Construction of ventilation shafts and associated access in Sections 9 and 16 would still be required. This alternative was dismissed from detailed analysis for multiple reasons.

There is a concern about reducing the overall visibility of the mine facilities, especially from the adjoining private land, the community of San Mateo, from Mt. Taylor, and those traveling Highway 605. The Section 16 topography is defined by long ridges and valleys. The facilities in this section were planned to be located as much as possible within the valleys, utilizing the ridges to hide them from view. By contrast, the portion of Section 10 that would house facilities is an open, gentle slope that is angled toward Mt. Taylor, the village of San Mateo, and the highway and, thus, almost all mine facilities located on this slope would be readily visible from these vantage points, as well as from adjacent private land. Placing the full facility on the topography of Section 10 would increase the visual impact of the mine.

There is a concern with increasing traffic on Highway 605 past the village of San Mateo. Locating one shaft and the mine facilities solely on Section 10 would funnel all traffic, including all haul trucks, past the village of San Mateo. This impact would be greater for this alternative versus locating the two shafts on Section 16 and 10, as proposed, or much greater than locating one shaft on Section 16.

The mine plan of operations proposed to access the ore in Section 16 and then expand the mine toward Section 10, where a second shaft was proposed to be constructed at a later date. Initial access to the ore-bearing zone was proposed for Section 16 because the ore body is shallower in Section 16 and the mine could be put into production sooner. The ore body in Section 10 is deeper, and would require an additional year of underground drilling before it could be accessed. In addition to the time factor, and also due to the depth of the ore body, the cost of a single shaft located in Section 10 would be more expensive than a single shaft in Section 16. Both are significant circumstances that would increase the costs of developing the mine before it could begin to generate revenue.

Another impact associated with locating a one-shaft mine all on Section 10 (except for the previously identified ventilation shafts) is that the surface footprint would be greater on Section 10 over a one-shaft alternative located all on Section 16. The total facilities footprint itself would be similar in size to that associated with a one-shaft alternative in Section 16, but since the shaft would be one-third deeper, one-third more waste rock would be generated in sinking the shaft. This would necessitate a larger area for storing rock associated with shaft construction. The total footprint (mine facilities plus all rock removed during shaft construction) for this alternative would be larger than the footprint for having a one-shaft facility located in Section 16.

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in table 3 is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 3. Impact comparison matrix

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
Geology and Soils	• No disturbance of surface topography and soils on Sections 9, 10, and 16. • No excavation within Westwater Canyon Formation, no extraction of uranium ore, and no back-filling of excavated spaces and rooms. • In sum, would have essentially no impacts on geology and soils at the RHR permit site.	• Hundreds of thousands to millions of cubic yards of ore and nonore rock would be mined and extracted over the life of the mine. • Permanent changes to the geologic character and structure of large volumes within the Westwater Canyon Member of the Morrison Formation. • Overall impacts to geology would be direct, long term, localized, moderate, probable, and of slight precedence or uniqueness. • Impacts on geology would be less than significant. • Direct, medium term to long term, localized adverse impacts on soils at mine site. • Placement of treated water (water reuse) pipeline would have negligible, short-term, localized effects on soils. • Upon completion of reclamation, soils should be stabilized sufficiently to support restoration of vegetation. • Disturbed soils would not recover 100 percent of their predisturbance condition for centuries. • In conclusion, impacts on both geology and soils would be less than significant.	• Impacts on geology very similar to alternative 2's impacts. • Impacts on geology would be less than significant. • Impacts on soils of a similar nature to those of alternative 2, but reduced in scale. • Alternative 3 reduces alternative 2's area of surface disturbance overall by 29%; 155 acres vs 218 acres. • Alternative 3 has a lower potential to disturb soils than alternative 2. • In sum, impacts on soils would be less than significant.

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
Surface Water Resources	• No impacts to surface water resources beyond the naturally occurring effects of storm water, erosion, flooding, and drought that are existing conditions at the site.	• Potential to adversely affect surface water resources, but these effects can be mitigated by appropriate actions during construction, operation, and reclamation. • Majority of potential surface water effects are associated with storm water and its impacts on water quality, sediment movement, and flooding. • Overall impacts on surface water, after all permit conditions and mitigation, would be direct and indirect, short term and long term, localized, minor, probable, and of slight precedence or uniqueness. • In conclusion, impacts on surface water would be less than significant. • Little or no cumulative effects on surface water resources.	• Effects on surface water would be very similar to but perhaps less than alternative 2, due to the reduced area of ground surface disturbance, most of which would be confined to Section 16 on State lands off the national forest. • Ground surface disturbance and localized impacts on surface water would be reduced on Sections 9 and 10 within the Cibola National Forest. • The same water quality mitigation measures and BMPs would be employed as in alternative 2. • Overall impacts on surface water, after all permit conditions and mitigation measures, would be direct and indirect, short term and long term, localized, minor, probable, and of slight precedence or uniqueness. • In conclusion, impacts on surface water would be less than significant.
Groundwater Resources Groundwater	• No mine constructed and no groundwater pumped out of the Westwater Canyon Member under Sections 9, 10, and 16. • No direct or indirect impacts on groundwater resources. • From other projects and actions, 20,000 AFY of new pumping from existing water rights, which would be an overestimate if there is little future mining development, but possibly low if uranium prices greatly increase.	• Model predicts mine dewatering would form cones of depression in pumped aquifers centered in the permit area and sized in proportion to the rate and total amount of pumping. • Maximum drawdown of Westwater at the mine site is 1,806 feet at the end of mining. • 100 years after mining has ceased, draw-down in the Westwater would still be both broad (10 foot drawdown about 17 miles out; 1 foot to as much as 27 miles out) and shallow (30 foot maximum drawdown at	• Impacts from the one-shaft alternative would be identical in kind and only slightly less in magnitude than from the two-shaft option (alternative 2). • Overall effects on groundwater would be direct and indirect, long term, of large extent and moderate magnitude. • Impacts adverse and significant. • Cumulative long-term effects from all possible actions likely to be significant.

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
Resources (cont.)	• From development of other mines, substantial cumulative impacts near Gallup, Crownpoint, Ambrosia Lake, and other potential mining areas where bulk of existing but currently unused water rights found.	mine itself). • These impacts are very large and long lasting, adverse, and significant. • No significant impact to San Mateo community well. • Impact on ranch well 143 would be immediate and large, reaching about 200 foot maximum drawdown; water levels recover after mining ceases. • No impact at Crownpoint, where community wells also draw from Westwater but are outside the cone of depression of the mine. • Would likely dry up Bridge Spring for foreseeable future. • No impact on other springs in vicinity of mine, including the following: San Miguel (Menefee), San José de Atarque (Mancos), or San Lucas, Maruca, La Mosca, El Rito, San Mateo, Cienega, Gooseberry, Gummi, and De Armand. • No significant impact of RHR pumping on Horace Springs; however, there may be a small cumulative effect on the springs as a result of combined pumping from all sources over the coming century. • Impacts to the San Juan River and Rio Puerco are minimized by distance but would be very long lasting. • Severe legacy impacts to groundwater quality would not occur, but could be some adverse water quality effects from backfilling and from increased waterflow	

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
		through the Westwater. • Overall effects on groundwater would be direct and indirect, long term, of large extent, and moderate magnitude. • Impacts adverse and significant. • Cumulative long-term effects from all possible actions likely to be significant.	
Air Quality	• No direct or indirect impacts to air quality. • No radon-222 releases to the air. • No environmental consequences from radon-222 emission. Background radon-222 concentrations in and around the proposed Roca Honda Mine would likely remain as they are today.	• Short- and medium-term minor adverse effects would be expected from criteria pollutants. • Short-term effects limited to fugitive dust and diesel emissions from drilling and heavy equipment during mine development. • Medium-term effects due to fugitive dust and heavy vehicle emissions during drilling and blasting and the transportation of materials during mine operation and reclamation. • Would not exceed *de minimis* thresholds under the general conformity rule, or contribute to a violation of any State, Federal, or local air regulation. • Radon doses to people living continuously or collecting wood in the vicinity of the mine would not exceed the safety standard of 10 mrem/y due to radon emissions from underground uranium mines. • Overall impacts on air quality adverse but less than significant.	• Impacts of alternative 3 on air quality, including radon-222 emissions, would be essentially the same as from alternative 2. • Overall impacts on air quality adverse but less than significant.

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
Vegetation	• Would have essentially no impacts on vegetation at the RHR permit site. • No disturbance of the site's vegetation communities and sensitive plants from clearing, grubbing, grading, and other project-related activities, either at the mine site or along the proposed treated water pipeline route. • Natural and unnatural disturbances may occur in the area, as they have in the past, but overall, the three communities now present – juniper savanna, piñon-juniper woodland, and grassland and/or shrubland – would be expected to remain for some decades into the future. • Over the coming decades, climate change's effects may begin to alter the vegetation composition and structure of the RHR permit area, with some species and commun-ities increasing in abundance while others decrease.	• A total of 218 acres of vegetation would be severely disturbed or essentially eliminated for the duration of the mine—183 acres within the three main sections (12 acres in Section 9; 71 acres in Section 10; and 100 acres in Section 16) plus 35 additional acres. • Most of the impacted acreage in Section 9 would be piñon-juniper woodland; in Section 10 desert grassland/shrubland; and in Section 16 juniper savanna and desert grassland/shrubland. • Unlikely to affect special status plant species. • Negligible to minor linear impacts to existing vegetation communities on approximately 84 acres of right-of-way along the proposed treated water pipeline route. • Overall impacts to vegetation would be both short term and long term (but not permanent). Short-term impacts would be adverse, localized, moderate in magnitude, probable, and of slight to moderate precedence/uniqueness. • Long-term impacts would be fewer because of proposed reclamation and mitigation. They would be adverse, localized, negligible to minor in magnitude, probable, and of slight uniqueness. • In sum, impacts on vegetation within the RHR permit area would be less than significant. • Cumulative impacts to vegetation are minor.	• Overall impacts on vegetation would be of a similar nature to but on a smaller scale (155 acres of disturbance) than those from alternative 2 (218 acres). • For duration of the mine, would result in disturbance or elimination of approximately 120 acres of vegetation, of which 20 acres would be Cibola National Forest lands in Sections 9 and 10—compared to 83 acres of Cibola National Forest vegetation adversely affected by alternative 2. • Alternative 3 reduces the area of impacts to vegetation from the mine itself overall by about 29% and the area of vegetation impacts on National Forest System lands by about three-quarters (76%). • Impacts would persist for about 2 decades, for the operational lifetime of the mine. Upon reclamation and revegetation, the magnitude and extent of these adverse effects would gradually diminish as restoration took place. • Not likely to affect special status plant species. • In sum, impacts on vegetation would be less than significant. • Cumulative impacts to vegetation are minor.

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
Wildlife	• No impacts from mine development, operation, and reclamation. • No wildlife mortality; habitat loss, degradation, and fragmentation; or displacement would occur. • Exposure to low levels of radioactivity in the environment from past mining projects would occur, but additional uranium and radon-related contamination would not occur. • Overall adverse effects from cumulative actions to wildlife would be minor, possible, long term, medium in extent, and slight in precedence.	• Mine development, operation, and reclamation may impact wildlife through mortality; habitat loss, alteration, degradation, and fragmentation; displacement; and exposure to chemical and radiation hazards associated with bioaccumulation in the air, soil, vegetation, and prey species. • Overall adverse impacts on wildlife, including bats and migratory birds, would be direct and indirect, short term and long term, localized, minor, to moderate probable, and of slight precedence. • Once mining activities have ceased and reclamation has occurred, both wildlife numbers and species diversity are expected to return to their pre-mine levels over a period of years as habitats are restored. • In sum, impacts on wildlife would be less than significant. • Cumulative effects on wildlife would be similar to those for vegetation because of the dependence of wildlife on habitat. • Past impacts to the piñon-juniper woodland habitat and wildlife in the project vicinity include livestock grazing, timber harvesting, recreation (e.g., hunting), exploratory drilling, mining, power line construction, timber harvesting, recreation, and access road construction. • No significant cumulative impacts are expected to occur to wildlife species, including any Forest Service listed sensitive, MIS, or migratory bird species or their habitat.	• Overall adverse impacts would be somewhat less than the impacts from alternative 2, because of reduced habitat conversion during mine construction and operations. • Impacts to general wildlife, including migratory birds and bats, would be qualitatively similar and quantitatively somewhat less than alternative 2. • Impacts would be direct and indirect, short term and long term, localized, minor to moderate probable, and of slight precedence or uniqueness. • In most instances, once mining activities have ceased and reclamation has occurred, both wildlife numbers and species diversity are expected to return to their pre-mine levels over a period of years as habitats are restored. • In sum, impacts on wildlife would be less than significant. • Cumulative effects would be similar to those of alternative 2.

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
Sensitive, Threatened, and Endangered Species	• No additional impacts to sensitive, threatened and endangered species with the no action alternative. • Wildlife mortality; habitat loss, degradation, and fragmentation; and displacement would not occur. • Exposure to radionuclides in the environment from past mining projects would occur, but additional radionuclide contamination would not occur. • Adverse effects to sensitive, threatened, and endangered species would be minor, possible, long term, and medium in extent, and slight in precedence.	• Conversion and development of wildlife habitat during mine operations could result in changes in the prey base of bats. • Habitat loss and disturbance could impact roosting sites for some bat species and cause some bat species to avoid the area. • Direct bat mortality could also occur. • Overall adverse effects to listed bats would be long term, minor to moderate in magnitude, and medium in extent. • After reclamation, populations of listed bat species expected to return in a few years to pre-mine levels. • Possible temporary, direct and indirect adverse effects to onsite Gunnison's prairie dogs from a variety of mine related activities. • Population recovery of the Gunnison's prairie dog expected after reclamation. • For duration of mining, possible direct or indirect adverse impacts to other State listed species, including the red fox, ringtail, western spotted skunk, peregrine falcon, loggerhead shrike, and gray vireo; recovery of each likely after reclamation. • Overall impacts would be direct and indirect, short term and long term, localized, minor to moderate, probable, and of slight precedence or uniqueness. • In sum, impacts to special status wildlife would be less than significant.	• Impacts to sensitive, threatened, and endangered species would be similar, but likely less than, impacts under alternative 2 because of the reduction in the project footprint and disturbed acreage. • Because fewer habitats and less acreage would be altered and developed, overall adverse effects to sensitive, threatened, and endangered species are expected to be less except to migratory birds. • Adverse effects to migratory birds are expected to be long term, minor to moderate in magnitude, and medium in extent, probable to possible and slight to moderate in precedence. • Once mining activities have ceased and reclamation has occurred, populations of any special status species which now occur within the permit area are likely to return to their pre-mine levels over a period of years as habitats are restored. • In conclusion, impacts on special status species would be less than significant. • Cumulative impacts on special status species of all reasonably foreseeable actions would likely be minor to moderately adverse but not significant.

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
Land Use	• Current land uses would remain in place on Sections 9 and 10, the Federal lands, on Section 16, the State of New Mexico lands, as well as on Sections 11, 15, 17, and 20, the private lands through which utility corridors and access roads would be utilized in the mining operations. • With existing land uses remaining as they currently are, there would be no effects to land use. • Overall impact on land use not significant.	• RHR would limit access to all of the development and operations areas to the extent necessary to protect public safety and control the work space. • To the extent that fencing and other access limiting controls are in place, those areas would not be available for the current land uses of grazing, firewood gathering, or hunting. • Temporary removal of some of lands as grazing allotments may have a restorative effect on forage production within those parcels on these lands that contain growing areas. • Because of the extended range of firearms and potential danger to mine workers, hunting activity may be restricted from access at a distance greater than simply the perimeter of fencing around the mine. • The proposed post-mining land use of grazing is consistent with the Cibola National Forest LRMP. • Overall impact on land use, while adverse, would not be significant.	• Effects are relatively similar to those of alternative 2, but on a somewhat smaller scale. • Overall impact on land use, while adverse, would not be significant.
Recreation	• Current recreational uses would continue on Sections 9 and 10, the Federal lands; and on Section 16, the State of New Mexico lands. • There would be no effects on recreation to consider, and the overall impact would be less than significant.	• Distance of the proposed mine from designated recreation sites is great enough that there would be a negligible direct effect on the recreation experience at these sites as a result of mining operations. • Existing recreational activities on and near the permit itself would be curtailed or restricted for the duration of the mine, or approximately two decades.	• Adverse effects on recreation are qualitatively similar to those of alternative 2, but on a somewhat smaller scale. • Overall impact on recreation would not be significant.

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
Recreation (cont.)		• Restrictions would temporarily limit hunting in a very small fraction of the area open to hunting within the Cibola National Forest and Mt. Taylor Ranger District. • Overall, impacts on recreation would be adverse, of minor magnitude, medium term in duration, small in extent, of probable likelihood, and slight precedence. • In sum, impacts would not be significant.	
Environmental Justice and Protection of Children	• Since ongoing activities would be substantially the same as those already occurring, no significant additional change in community character and setting would be anticipated. • Existing conditions would remain substantially unchanged and have no effect on the populations of concern.	• Would potentially create beneficial impacts due to the provision of jobs and economic opportunities in minority and low-income communities. • Potential adverse impacts of minor magnitude due to potential health risks for miners and nearby residents of San Mateo, as well as adverse impacts associated with increased income. • Adverse mental health impacts of moderate magnitude would occur to tribal environmental justice communities due to mine development so close to spiritually significant Mt. Taylor. • Health impacts to miners from exposure to radon and other environmental hazards is possible. • Provision of jobs to environmental justice communities would be medium term to long term and last roughly 2 decades; impacts would be reversed in the long term once the mine closes and well paying mining jobs are lost.	• Impacts from the one-shaft alternative would be essentially identical to those of alternative 2.
Environmental Justice		• Health risks to miners would be both short	

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
and Protection of Children (cont.)		and long term, as diseases from radiation or toxics exposure may become manifest after the mine's lifetime. • Not expected to disproportionately expose children to toxic substances, radionuclides, or other safety hazards. • Would potentially create impacts of negligible to minor magnitude due to increased risk of inhaling fugitive dust and exhaust emissions from vehicles and mining equipment. • Both beneficial and adverse effects on EJ would likely be significant. • Moderately beneficial and adverse cumulative effects related to environmental justice would likely occur. • Beneficial and adverse cumulative effects would likely be significant.	
Socioeconomics Socioeconomics (cont.)	• No socioeconomic changes would occur to the counties in the ROI. • Since ongoing activities would be substantially the same as those already occurring, no significant additional change in community character and setting would be anticipated.	• Would potentially create beneficial impacts of moderate magnitude due to the creation of jobs, labor income, and tax revenues. • Overall, would support over a billion dollars in economic activity, about 2,400 jobs with salaries worth $355 million, and generate $81 million in local and State revenue during the life of the project. • Although it would yield tangible economic benefits for the region during its approximately 2 decades of construction, operation, and reclamation, the mine remains controversial due to the historical uranium boom and bust cycles that have	• Direct, indirect, and cumulative socioeconomic impacts would be virtually identical to those of alternative 2.

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
		occurred in the region and elsewhere. • Provided the global price of uranium remains favorable, several other reasonably foreseeable exploration and mining projects are also likely to occur. • Under this scenario, the projects in combination would support several billion dollars in economic activity, which would represent a significantly beneficial cumulative economic impact for the ROI over the coming decades, though perhaps not a source of permanent prosperity.	
Cultural and Historic Resources Cultural and Historic	• No additional impacts to cultural resources from mine development, operation, and reclamation. • Impacts to cultural resources already occurring from livestock management and access to the area by the public would continue; these include vandalism, trampling, and inadvertent damage. • Adverse impacts to cultural resources would be less than significant.	• Would cause adverse impacts to tribal cultural resources and practices related to the sacred character of Mt. Taylor for the Acoma, Laguna, Zuni, Hopi, and Navajo in particular. • Would adversely affect the Mt. Taylor TCP and cause irreparable harm to surrounding tribes and their traditional cultural practices. • Would have a perceived impact upon the Spirit Beings associated with the TCP. • Would cause adverse effects in the view of the tribes because of concerns about the toxic nature of uranium and the perceived waste of water, the lifeblood of the sacred mountain. • Ground disturbance from construction activities would result in direct physical impacts to four historic properties, plus the Mt. Taylor TCP, which would be permanent and severe in magnitude. • Construction of mine facilities would	• Direct and indirect impacts to historic properties and other cultural resources identified by the tribes would occur. • Direct and indirect adverse effects to historic properties, to natural features within the setting of historic properties, and to the visual and audible characteristics of historic property settings would occur. • Direct physical impacts would occur to four historic properties, plus the Mt. Taylor TCP. • During the operational phase, indirect physical disturbance of historic properties could occur from changed erosion patterns, inadvertent impacts, and vandalism or illegal artifact collecting. • Due to less development in Section 10 with less ground disturbance, fewer surface facilities, and less activity and traffic, the totality of the impacts to the Mt. Taylor TCP and related resources would be less

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
Resources (cont.)		result in impacts to physical features within the Mt. Taylor TCP's setting that contribute to its historic significance. • During the operational phase, indirect physical disturbance of historic properties could occur from changed erosion patterns, inadvertent impacts, and vandalism or illegal artifact collecting. • Operation and reclamation activities at would continue to introduce visual and audible elements out of character with the Mt. Taylor TCP, further impacting the setting of this historic property. • After reclamation, the setting of the Mt. Taylor TCP would not be the same as it is currently, but the reclaimed area would fit in with the surrounding landscape. • Would cause impacts to natural resources with cultural value, such as springs, aquifers, wildlife and vegetation. • In sum, impacts on cultural resources would be significant, and the proposed action would result in an adverse effect to historic properties. • Other past, current, and future projects are also anticipated to result in significant impacts. • Cumulative effect of the proposed action in combination with others would be adverse and significant, exacerbating loss of integrity of Mt. Taylor TCP.	than alternative 2. • Impacts on cultural resources would still be significant, and alternative 3 would result in an adverse effect to historic properties. • Other past, current, and future projects are also anticipated to result in significant impacts. • Cumulative effect of alternative 3 in combination with others would be adverse and significant, exacerbating loss of integrity of Mt. Taylor TCP.
Visual Resources	• Visual aesthetics at the proposed site would remain unchanged.	• Mining operation plan describes the following practices that would take place to follow the naturally established form,	• Viewshed is smaller than that of alternative 2, in that the area east and northeast of

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
	• Would have no impacts to visual resources.	line, and color: - All exterior colors will be selected from a list of colors approved by Forest Service. - The combination of use of existing vegetation, berming of soil wherever possible, vegetation of exposed stockpiles, and selection of appropriate use of color schemes for the facilities will all aid in mitigating impact to scenic values. - At Section 10, scenic values will be protected by utilizing the existing vegetation as a visual break between the facility and the public road. • Magnitude of impacts to the permit area would fit in with the Forest Service visual quality objectives for the area. Therefore, the magnitude of impacts would be minor. • Largest impact would be from viewers on Mt. Taylor. • Overall impacts to visual resources would be adverse but not significant. • Cumulative impact on visual resources would be medium term but impermanent and adverse but not significantly adverse.	Section 10 would not be impacted. • Impacts to visual resources would be of minor magnitude, medium term, of a small extent, probable, and of moderate uniqueness. • Moderate uniqueness is due to the proximity of the proposed mine to Mt. Taylor. • The small extent of the impacts is mainly due to the small number of viewers; this is especially because the facilities would not been seen from any major roadways. • Largest impact would be from viewers on Mt. Taylor. • Overall impacts to visual resources would be adverse but not significant. • Cumulative impact on visual resources would be medium term but impermanent and adverse but not significantly adverse.
Transportation	• No impacts to transportation resources. • Conditions would remain as described under the "Transportation Affected Environment" section.	• Would have short and long term minor effects to transportation. • Short-term effects during mine development and reclamation would be due to the delivery of heavy equipment, pipe, water treatment equipment and supplies, as well as their removal during reclamation activities. • Long-term minor effects would be due to	• Impacts would be broadly similar to alternative 2. • Forest Service roads in Sections 9 and 10 would not be used. • County Road 605 would be the arterial roadway leading to the site and aggregate access roads would be developed.

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
		ore hauling trucks, continued delivery of supplies, and worker commutes. • Would contribute small changes in localized traffic patterns. • Would have no impact on public transit or air traffic in the area. • Traffic congestion would increase at and around the site due to additional heavy vehicles associated with mine development. • Upgrades to roadways accessing the site would make local road infrastructure sufficient to support mining activities. • To haul uranium ore, about 50 truck trips per 24 hours or about 2.1 trucks per hour would be expected in each direction. • Risks from transportation of uranium ore are dominated by conventional risks associated with virtually all commercial transportation and the probability of accident related fatalities is no different than those associated with conventional truck transportation. • Long-term beneficial effects would be due to upgrades to roadways. • No significant cumulative effects expected.	
Human Health and Safety	• Conditions described under the "Affected Environment" section for "Human Health and Safety" would continue for the foreseeable future. • Not expected to have any impact	• May entail direct and indirect effects on five important pathways related to the health and safety: traffic safety; noise; environmental exposure; impacts stemming from employment; and impacts stemming from in-migrating workers.	• Impacts on human health and safety would be essentially identical to alternative 2.

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
	on these conditions.	• Impacts to traffic safety expected to be of minor to moderate magnitude, to have a medium to large geographic extent, and to be of short- to medium-term duration. • Overall impact on traffic safety would be adverse but less than significant. • The remoteness of the project site means that human receptors unlikely to face noise above the 40-55 dBA range. • However, it is possible that some residents along haul routes would become annoyed with increased noise levels due to truck traffic. • Overall noise impacts would be adverse but not significantly adverse. • While actual contamination of water, air, and soil is predicted to be minor or minimal at most, perceived contamination on the part of Native Americans, along with actual changes to water and land from the project in the vicinity of sacred lands, especially within the context of uranium mining and milling legacy issues, may have real effects on the mental and physical health of some community members. • In sum, likely impacts to health from environmental exposures are expected to be of moderate magnitude, to have a medium geographic extent, and to be of medium- to long-term duration. • Overall level of environmental health impacts would be less than significant.	

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
		• Resulting employment has the potential to impact health through two pathways: providing jobs and income to individuals and exposing those individuals to a specific set of working conditions. • Jobs and income are strongly associated with a number of beneficial health outcomes such as an increase in life expectancy, improved child health status, improved mental health, and reduced rates of chronic and acute disease morbidity and mortality. • At the same time, in some settings, income and employment also promote a number of adverse health outcomes such as social pathologies. • Overall, positive impacts to health stemming from employment would be less than significant. • Potential adverse effects on health stemming from employment would be less than significant. • Introduction of a transient workforce population into an established community often changes the social functioning of that community in negative ways. • Increased rates of sexually transmitted diseases are common when male worker populations making high wages are sited near small/medium-sized communities. • Workforce migration has potential to increase rates of infectious respiratory disease.	

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
		• May increase demand on local health care services through the direct or indirect increase of certain conditions including alcohol and drug related issues, social pathology and increased rates of infectious disease. • Overall impacts to health stemming from workforce migration would be less than significant. • Stress and anxiety levels of residents in the ROI and, in turn, the mental, physical, and social health effects of these feelings, are affected by both historical and present-day factors, which include known and unknown health effects of uranium mining and large number of unreclaimed and contaminated mine sites within the area. • High levels of poverty and the past reality and future possibility of a boom-bust cycle magnify the potential for impacts to mental health in the ROI. • Overall cumulative impacts on human health and safety would be significant.	

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
Legacy Issues	• Because of little or lax regulation during the earlier (pre-1990s) round of uranium mining, New Mexico was left with a legacy of environmental contamination and health problems. • Legacy issues associated with contamination and health and safety impacts from past uranium mining and milling would continue for the foreseeable future. • Ongoing environmental cleanup, reclamation, and remediation would gradually reduce actual levels of contamination and potential exposure but confidence would take longer to be restored and certain long-term health effects from past exposures would continue to play out. • Elevated lung cancer rates were documented in underground uranium miners, especially among those who also smoked. • Uranium mill workers exposed to uranium dusts and mill products showed no clear evidence of uranium-related disease, indicating that exposure to normal levels of uranium ore was not an acute health risk, unlike exposure to radon within	• Same as alternative 1. • The lack of open pit mining, leachate treatment, ore milling, in situ leachate handling, and wastepile disposal; and the requirements for ventilation and similar health and safety requirements of current uranium mining regulations suggest that there is little or no connection between the legacy health issues of uranium mining and processing in the past, and anticipated health and safety effects from the proposed Roca Honda Mine.	• Same as alternative 2.

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
Legacy Issues (cont.)	an enclosed mine. • Native American miners had more nonmalignant respiratory disease from underground uranium mining, and less disease from smoking, than other miners, and were less likely to receive compensation for mining-related disease. • According to one recent study, the excesses of lung cancer among men seem likely to be due to previously reported risks among underground miners from exposure to radon gas and its decay products. • With the exception of male lung cancer, this study provided no clear or consistent evidence that operation of uranium mills and mines adversely affected cancer incidence or mortality of Cibola County residents in general. • The Radiation Exposure Compensation Act (RECA) of 1990 required payments to uranium miners diagnosed with cancer or other respiratory ailments; subsequent amendments expanded the number of claimants. • The Uranium Mill Tailings Radiation Control Act (UMTRA) of 1978 was passed to ensure that uranium mill		

Topic	Alternative 1 – No Action	Alternative 2 – Proposed Action (Two-shaft alternative)	Alternative 3 – One-shaft Alternative
	tailings be managed and cleaned up as appropriate; it designated 22 inactive uranium ore processing sites for remediation, including Shiprock and Ambrosia Lake in New Mexico.		

Other Actions and Projects Considered in Cumulative Effects Analysis

Introduction

The mile-deep Grand Canyon of the Colorado River in Arizona is a dramatic illustration of cumulative impacts, although in this case from natural forces—erosion occurring over 6 million years—rather than human causes.

In the context of NEPA and EISs, the Council on Environmental Quality's (CEQ) Regulations (40 CFR 1500–1508) implementing the procedural provisions of NEPA, as amended (42 USC 4321 et seq.), define cumulative effects as:

> …the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other action. (40 CFR 1508.7)

Cumulative effects may be adverse, beneficial, or both.

Incorporating the principles of cumulative effects analysis into the environmental impact assessment of a proposed action should address the following:

- Past, present, and future actions;
- Other Federal, non-Federal, and private actions;
- Impacts on each affected resource, ecosystem, and human community; and
- Truly meaningful effects.

In analyzing cumulative impacts, spatial and temporal boundaries should be considered. These form the context of the cumulative analysis. Judgment should be used in choosing the most appropriate boundaries to meaningfully assess the role of the proposed action, secondary actions, and connected actions in comparison with overall effects from all past, present, and future actions. If spatial and temporal boundaries are set too narrow, this will tend to overstate the relative importance of the proposed action compared with others, but perhaps reduce the overall cumulative scale of impacts to a misleadingly small magnitude.

In contrast, if spatial and temporal boundaries are set too broad, the contribution of the proposed action to cumulative impacts will be unduly small in comparison with the contributions of all other actions, but the overall scale of cumulative effects may be enormous and exaggerated. Consider the example of a proposed action that in conjunction with all others was predicted to lead cumulatively to the extinction of a given species. If a cumulative impacts analysis considered this phenomenon in the context of a geologic time scale measured in millions of years, during which time a number of species could disappear while new ones evolved, such an analysis would improperly diminish the significance of cumulative impacts leading to the permanent extinction of the species in question.

Ideally, natural boundaries should be used, but sometimes institutional or geographic boundaries are relevant as well, especially when certain key impacts weigh as much on the human

environment as the natural environment. Spatial boundaries may also vary by resource topic. In the present cumulative analysis, McKinley and Cibola Counties boundaries may be the most appropriate for some resource topics, the State of New Mexico's the most appropriate for others, and the nearest reaches of the Rio Puerco or Rio Grande for still others. However, a number of impacts to which the proposed action and secondary and connected actions might hypothetically contribute incrementally are much further away, much larger, or widely dispersed, such as the widely separated winter and summer ranges of migratory birds, which may be thousands of miles apart, connected by a migratory flyway.

Past, Present, and "Reasonably Foreseeable" Future Actions

Uranium Mines

JJ No. 1/L-Bar Mine

Past Mine

The JJ No. 1 Mine, located about 10 air miles north-northeast of Laguna Pueblo in Cibola County, was an underground uranium mine which produced uranium ore from a depth of 500–600 feet below ground surface for a period of about 5 years from 1976 to 1981. From 1981–1986 it was on standby status due to low uranium prices; reclamation began in 1986. The L-Bar mill associated with the mine was demolished at this time and the mill and tailings areas were reclaimed between 1986 and 1989. An interim radon barrier was placed in 1989 to cover tailings and the contiguous mill area. After settlement and consolidation of the tailings area from 1989 to 2000, the final radon barrier cover was installed in 2000. The covered tailings and mill area, including the area of the mine headframe and one of the 12 vent shafts, were transferred to the Department of Energy (DOE) Office of Legacy Management in December 2004. Beyond this area, the only evidence of the former mine, prior to the closeout activities, were 11 capped steel vent shafts and associated cement pads, steel gravel shoots, and two-track trails between the vent shafts (figure 23). Final closure of these vent shafts will permanently stabilize the surface and eliminate any potential hazards to humans or wildlife (Intera, 2011a).

Figure 23. JJ No. 1/L-Bar Mine site (after reclamation)

The surrounding terrain is hilly and the ground surface rocky. The goal of reclamation was to return the topography at each of the vent shaft pads to a condition similar to that of the pre-mining natural topography. The challenge was to establish natural grades while limiting disturbance to stable slopes and vegetated areas. Backfilled soils were then placed on the reclaimed areas, compacted, and graded. The reclaimed areas were then revegetated by conditioning the soils (adding mulch, compost, and an organic fertilizer) and reseeding the areas. The seed mix selected for the site was formulated specifically for this arid desert region to establish plant life as quickly as possible, as well as achieve long-term growth and survival in a highly erosive setting. The seed mixture (applied at a rate of 17.12 lbs/acre) was mixed with a granular Mycorrhizae (applied at a rate of 20 lbs/acre) before being hand broadcast. The revegetation monitoring program will continue for 12 years or as long as required by MMD (Intera, 2011a).

San Mateo Uranium Mine

Past mine, Current Cleanup

Conventional Underground Uranium Mine

The San Mateo Mine site is located on the Cibola National Forest's Mt. Taylor Ranger District, approximately 5.5 miles west of the town of San Mateo. This inactive mine operated sporadically from 1959 through 1971, then briefly in the 1980s under four different operators. No uranium ore was milled onsite. Waste rock was disposed at the head of the mine in a series of waste rock terraces. Although not typically ore quality, it can contain elevated concentrations of uranium, its decay products, and other heavy metals. In addition, a pad consisting of material similar to the main waste rock pile was constructed on a flat area northeast of the main rock pile. Since closure of the mine, all buildings and surface facilities have been removed (though foundations remain), and the main shaft and all emergency shafts and air shafts have been sealed. The mine road, waste rock pile, north pad, and several settlings ponds remain at the site (USFS, 2009a).

The San Mateo Mine area is not a popular recreation area due to its remote, inaccessible setting. Although camping is allowed, there is no indication of overnight use. Uranium-bearing rock exposed by mining is a source of elevated gamma radiation, to which hunters, hikers, and/or ATV-riders can be exposed by walking or driving through the area. These areas include the waste rock pile where remnants of uranium-bearing rock formation may be exposed (USFS, 2009a).

The Forest Service has recently started the reclamation process, placing a geo-membrane cover with rock armoring.

Mt. Taylor Uranium Mine

Past Mine; Either Future Mine or Reclamation

Conventional Underground Mine

The inactive Mt. Taylor Mine is located about 1/2 mile northeast of the village of San Mateo and is accessible from New Mexico State Route 605. It was developed in the 1970s by Gulf Mineral Resources Company. After excavating two 3,300-foot shafts, Gulf began production in 1980 using the room-and-pillar and stope mining methods; production continued until September 1982, when the market price of uranium dropped suddenly, causing a temporary cessation of production. Mine water continued to be pumped during this shutdown period. Mining resumed but was suspended again in 1990, and has not taken place since then (RGRC, 2012).

Gaining access to the ore zones required dewatering of the mine, which began in the mid-1970s. Mine water was treated prior to discharge. Approximately 675,085 tons of ore and 698,000 tons of waste rock were mined from the Morrison Formation. Ore was shipped offsite for milling. Waste rock from shaft sinking (shaft muck) and from mine development was placed in an onsite waste rock pile (RGRC, 2012).

It is expected that operations at this mine will resume once more now that the uranium market is more favorable.

Cebolleta Uranium Mine

Future Mine

Conventional Underground and Open Pit

This project is located in Cibola County. Neutron Energy submitted an application and sampling and analysis plan to NM MMD in March 2012 for up to 84 holes that would be drilled on 14 acres of previously disturbed private land. Drilling using conventional truck-mounted rigs and supporting equipment was to have begun in May 2012 and be completed within 8–10 weeks. The purpose of the drilling is to determine whether enough uranium ore occurs to justify mine development on this privately owned land (MMD, 2012a).

La Jara Mesa Uranium Mine

Future Mine

Conventional Underground

Over a period of 20 years, Laramide Resources proposes to tunnel two inclined adits (horizontal or nearly horizontal passages) from under the west edge of La Jara Mesa, on the Cibola National Forest approximately 10 miles northeast of Grants, to remove 40,000 tons of uranium ore for testing and to begin development of a production mine. This project is located about 8 air miles from the proposed Roca Honda Mine. Disturbance on the 16.4 acres would include improvements to existing roads, construction of a new water pipeline and electric distribution line in the road right-of-way, and an escape raise/air vent at the top of La Jara Mesa. If approved, this project would operate concurrently with the Roca Honda Mine. A draft EIS on this proposal was released to the public in June 2012 (USFS, 2009b; USFS, 2012a).

Uranium Exploration

Combined Uranium Exploratory Drilling Project

Future

There is a proposal to approve multiple plans of operation for exploratory drilling to determine the extent of uranium deposits in several areas on the mesas surrounding Mt. Taylor, including San Mateo Mesa and La Jara Mesa northeast of Grants. Cibola National Forest is currently preparing the EIS for this exploratory drilling (USFS, 2012b).

Marquez Canyon Exploration

Current

In 2009, Neutron Energy applied for permission to drill up to 44 holes 2,500 feet in depth in Marquez Canyon of McKinley County. The permit was renewed in 2012. Drilling activities would disturb approximately 10 acres of land surface and drill pads would have to be reclaimed upon completion. BMPs are to implemented at all surface disturbances and temporary low water crossings during exploration and reclamation activities, as needed for erosion control, spill prevention, and avoidance of damage to ephemeral stream channels in the area (MMD, 2009a).

Mesa Montanosa Exploration

Current

Under the conditions of a permit renewed in 2012, permittee Grants Ridge, Inc., is authorized to conduct mineral exploration (drilling boreholes) and reclamation operations on approximately 5 acres situated on BLM land in McKinley County (MMD, 2012b).

Elizabeth Claims Exploration

Current

The Elizabeth Claims Exploration project area is located on private lands within the Ambrosia Lake Mining District approximately 20 miles northwest of Grants. It consists of 28 drill holes, 5.5 inches wide and up to 1,800 feet deep. About 5 acres of surface area would be disturbed and reclaimed upon completion of the exploration (MMD, 2009b). MMD renewed this permit in August 2011.

Uranium Mills

Ambrosia Lake Disposal Site (former uranium mill)

Past

The Ambrosia Lake disposal site was a uranium mill (ore-processing facility) located near the center of the Grants Mineral Belt, within the Ambrosia Lake Mining District of McKinley County approximately 25 miles north of Grants. The Ambrosia Lake Valley is a thinly populated area characterized by desert grassland and bordered by basalt-capped mesas to the north (DOE, 2011).

Built by Phillips Petroleum Company in 1957, the Ambrosia Lake mill processed more than 3 million tons of uranium ore between 1958 and 1963, providing uranium for U.S. national defense programs. In the late 1970s to early 1980s, United Nuclear Corporation operated an ion exchange system, extracting uranium from mine water. All operations came to an end in 1982, leaving behind radioactive mill tailings, a predominantly sandy material, on approximately 111 acres. Wind and water erosion dispersed some of these tailings across a 230-acre area (DOE, 2011).

After Congress passed the Uranium Mill Tailings Radiation Control Act (UMTRCA) in 1978, the U.S. Department of Energy (DOE) remediated the Ambrosia Lake site between 1987 and 1995, under the Uranium Mill Tailings Remedial Action Project and in accordance with standards promulgated by the U.S. EPA in Title 40 (CFR) Part 192 (DOE, 2001; DOE, 2011). DOE closed the 91-acre disposal cell in 1995 upon consolidation and encapsulation of the tailings and completion of the cell cover. The cell contains almost 7 million dry tons of contaminated

material, with total radioactivity of 1,850 curies of radium-226. The uppermost aquifer beneath the site consists of alluvium (river deposits), sandstone, and weathered shale. This uppermost aquifer is not a current or potential source of drinking water because of its low yield (DOE, 2011).

Rising about 50 feet above the surrounding flat terrain, the rectangular disposal cell is approximately 2,500 feet long by 1,600 feet wide, including the toe apron. Its cover consists of several layers designed to encapsulate and seal off the contaminated materials. The disposal cell cover includes a low-permeability radon barrier (first layer placed over compacted tailings) comprised of compacted clayey soil, a bedding layer of granular bedding material, and a rock (riprap) erosion protection layer for the top and side slopes (figure 24). In accordance with 40 CFR 192.32, the disposal cell is designed to last 1,000 years, to the extent reasonably achievable, and, in any event, for at least 200 years (DOE, 2011).

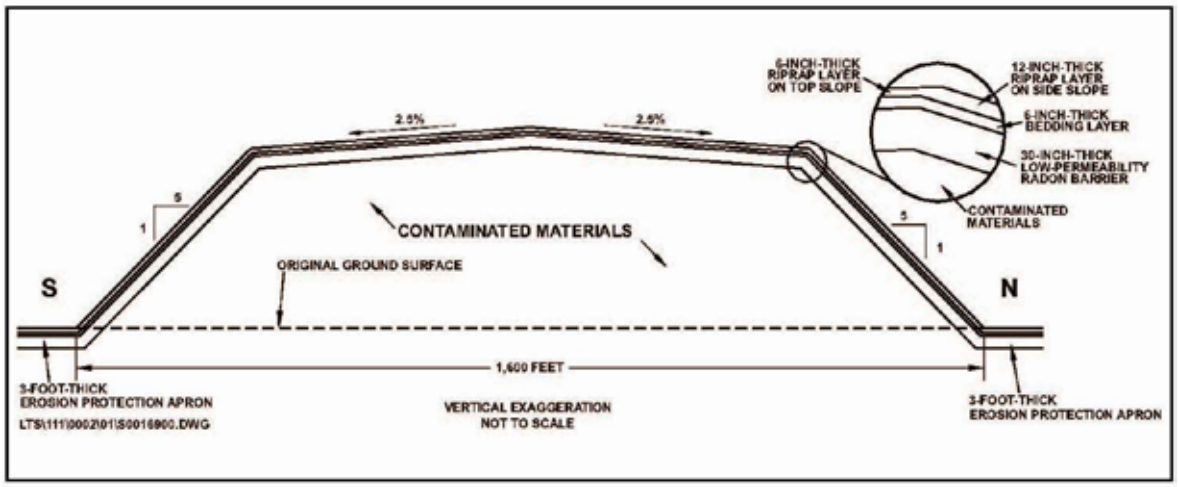

Figure 24. South-north cross-section of Ambrosia Lake disposal cell

The DOE's Office of Legacy Management (LM) manages the Ambrosia Lake disposal site according to a site-specific long-term surveillance plan to prevent the release of radioactive contaminants to the environment. Under provisions of this plan, LM conducts annual inspections of the site to evaluate the condition of surface features, performs site maintenance as necessary, and samples two monitoring wells every 3 years. The encapsulated tailings will remain potentially hazardous for thousands of years. However, the NRC general license for UMTRCA Title I sites has no expiration date, and LM's responsibility for the safety and integrity of the Ambrosia Lake disposal site will last indefinitely (DOE, 2011).

Rio Algom Mine and Mill Tailings Site (Ambrosia Lake area)

Past; Current Reclamation

The Rio Algom Mine and mill tailings site is in the Ambrosia Lake uranium district. Located about 25 miles north of Grants, this tailings impoundment contains 33 million tons of uranium ore and covers an area of approximately 370 acres.

The site status changed from standby to reclamation in 2003, reflecting the licensee's intent to begin full demolition and reclamation. The mill was demolished and disposed of in the tailings

impoundment in late 2003. Consequently, all groundwater corrective actions have been discontinued, and Rio Algom is finalizing the site tailings reclamation. A portion of the tailings impoundment is still open for disposal of Atomic Energy Act, Section 11e.(2) byproduct material. A final soil DP entitled, "Closure Plan - Lined Evaporation Ponds" (relocation plan) was submitted to the NRC in November of 2004, and partially approved. A portion of the report, pertinent to the "Section 4" and Pond 9 evaporation pond sediment material has been reviewed and approved. The final licensing action will be the approval of a redesigned channel. The cost for decommissioning is estimated to be approximately $18 million (USNRC, 2012a).

Other Past, Present, Future, and Ongoing Actions

Other cumulative impacts on environmental resources from actions occurring on and near the Mt. Taylor Ranger District—and Cibola and McKinley Counties more broadly—during and after the projected 2-decade life of the Roca Honda Mine may occur from a variety of other ongoing actions. These include:

- **Timber projects** – includes use of heavy equipment in timber harvesting, log skidding, use of existing access roads, and construction and reclamation of temporary access.
- **Wildlife habitat improvements** – includes vegetation treatments such as forest thinning, prescribed burning, seeding of grasses, and water source development.
- **Firewood gathering** – includes permitted collection of dead-and-down and greenwood trees using hand-held equipment and existing access.
- **Piñon nut gathering** – includes the gathering of piñon nuts on foot.
- **Wildland fire management** – includes wildland fire suppression, fuel management, prescribed fire, involving the use of hand-held firefighting equipment and heavy machinery such as planes and dozers. Wildland fires are unpredictable in location, size, and severity of impact. These activities occur at a low level because there is very little fire frequency in the area and a long natural fire return interval.
- **Livestock grazing** – includes permittees using the area for grazing cattle, water development (e.g., earthen or fiberglass tanks,well drilling, pipelines), fencing, and scheduled movement of cattle from one grazing area to another.
- **Recreation** – includes hunting, hiking, camping, mountain biking, ATV/dirt bike use, 4-wheel drive use, and winter sports on Mt. Taylor (e.g., cross-country skiing, snowshoeing, snowmobiling). Specific activities and facilities include the Mt. Taylor 50-kilometer running race, use and maintenance of the Continetal Divide Trail, the annual winter quadrathalon on Mt. Taylor. Ongoing activities include maintenance and improvement of trails, campgrounds, and picnic areas.
- **Road and utility corridor maintenance** – includes mechanical clearing and use of herbicides to control vegetation along power line and pipeline rights-of-way, as well as use of heavy equipment like graders, snowplows, backhoes, trucks, and bulldozers.
- **Construction and maintenance of communication sites** – includes maintenance of communication sites on Mt. Taylor, involving making use of existing access.
- **Renewable energy projects** – includes developments off the Cibola National Forest, such as the wind farm northeast of Bibo, in Cibola County, New Mexico.